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REPORT

OF THE

METEOROLOGICAL COUNCIL

TO THE

ROYAL SOCIETY,

For the Year ending 31st of March 1884.

Presented to both Houses of Parliament by Command of Her Majesty.

FEBRUARY 1885.

LONDON:
PRINTED BY EYRE AND SPOTTISWOODE.

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1885.

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THE METEOROLOGICAL COUNCIL,

1883–84.

Lieutenant-General RICHARD STRACHEY, C.S.I., F.R.S., Chairman.

MR. WARREN DE LA RUE, D.C.L., F.R.S.

Captain SIR FREDERICK J. O. EVANS, K.C.B., F.R.S., Hydrographer of the Admiralty.

MR. FRANCIS GALTON, F.R.S.

Professor GEORGE GABRIEL STOKES, F.R.S.

MR. EDWARD J. STONE, F.R.S.

REPORT

OF THE

METEOROLOGICAL COUNCIL

TO THE

ROYAL SOCIETY,

For the Year ending March 31, 1884.

Introductory.

THERE has been no change in the Council during the year, and the executive officers continue as before :—

Mr. R. H. Scott, M.A., F.R.S., Secretary.
Captain H. Toynbee, F.R.A.S., Marine Superintendent.
Navigating-Lieutenant C. W. Baillie, F.R.A.S., Assistant do.

The present Report is as usual arranged under three headings :—

I. Ocean Meteorology.
II. Weather Telegraphy.
III. Land Meteorology of the British Isles.

PART I.

OCEAN METEOROLOGY.

Collection of information.

Collection of Information.—The period for which the Council had undertaken to collect special information on an extensive scale from the North Atlantic, as explained in the last Report, expired at the end of August 1883, and the Office has therefore returned to its normal practice as regards its dealing with observers at sea.

A concise account of the practice at present followed will be found in Appendix I. (p. 27).

Presentation of charts to observers.

Appendix II. (p. 29) contains a list of all the observers who have contributed "excellent" logs during the past year. Some of them have regularly co-operated with the Office for many years; the names which now appear in the list for the first time are as follows:—

Captain's Name.	Ship.
Adams, Sub.-Lieut. R. P., R.N.	H.M.S. "Dart."
Adamson, John	"Roman Empire."
Alderton, T.	S.S. "Australia."
Ballard, H.	S.S. "Durban."
Barlow, Brabazon J.	S.S. "Amarapoora."

Presentation of charts to observers.

Captain's Name.	Ship.
Boothby, George C. - - -	S.S. "Circassia."
Bolton, S. H. - - -	S.S. "Tyne Queen."
Bristow, W. M. - - -	"Undine."
Christie, John D. - - -	S.S. "Erl King."
Clarke, James - - -	S.S. "Olbers."
Cooke, Charles F. - - -	"The Lord Warden."
Crotty, J. H. - - -	"Evesham Abbey."
Denham, George - - -	S.S. "Erl King."
Donaldson, James - - -	S.S. "Bolivia."
Dunbar, John Ivor - - -	S.S. "Martaban."
England, Thomas - - -	"Jane."
Grey, C., R.N.R. - - -	"MacMillan."
Jones, Edward, R.N.R. - -	S.S. "Drummond Castle."
McBride, A. C. - - -	"Island Belle."
McDougall, A. - - -	"Auckland."
Milne, W. F. - - -	S.S. "Esquimaux."
Moore, Lieut. and Commr. W. U., R.N.	H.M.S. "Dart."
Neale, Mr. W. H., M.B. - -	"Eira."
Oldham, Lieut. in Command, C.F., R.N.	H.M.S. "Lark."
Pagan, James - - -	S.S. "Tenasserim."
Pirie, Lieut. George, R.N. - -	H.M.S. "Flying Fish."
Pomeroy, H. - - -	"Elissa."
Price, J. H. - - - -	"Viola."
Richardson, Sub.-Lieut. Wyndham, R.N.	H.M.S. "Sylvia."
Rosseter, William Lawrence -	"St. Kilda."
Smith, Mr. B. Leigh - -	"Eira."
Steven, David - - -	"Inch Keith."
Strang, Robert - - -	"Lyttleton."
Thorpe, J. - - - -	"Thurland Castle."
Vereker, Hon. Foley C. P., R.N. -	H.M.S. "Magpie."
Wait, A. McLean - - -	S.S. "Spartan."
Walker, Henry - - -	S.S. "Parthia" and S.S. "Cephalonia."
Whall, William B. - - -	S.S. "Drummond Castle."
Williams, E. M. - - -	"Burdwan."

The Council regret deeply to have to record the death of Captain J. M'Donald Gray, who had been an "excellent" observer for more than 13 years.

Proportion of "excellent" to total number of logs received.

The following is the total number of logs received from April 1, 1883, to March 31, 1884, and the number of logs which have been classed as "excellent":—

Total No. of Logs received.	No. of Excellent Logs.	Per-centage of Excellent Logs.
176	132	75

The average number of logs received annually during the five years, 1878–82, was 151, and the per-centage of excellent logs among these was 66.

The Council take this opportunity of expressing their best thanks to the observers who have assisted them during the past year.

On the 31st of March 1884 the ships carrying instruments supplied by the Office were pursuing the following voyages:— Districts from which observations are obtained.

To Baffin's Bay or Greenland	6
„ North America, East Coast	11
„ „ „ West „	3
Off East Coast of North America	4
To South America, East Coast	13
„ „ „ West „	3
„ Australia and New Zealand, viâ Cape of Good Hope	26
„ „ „ „ Suez	3
„ India, viâ Suez	2
„ India, viâ Cape of Good Hope	20
„ China Seas, viâ Cape of Good Hope	5
„ „ „ Suez	6
„ Mediterranean Ports	5
„ Cape of Good Hope	10
„ West Indies	2
Between British Ports	2
Unknown	18
Total number of ships	139

Appendix III. (p. 32) supplies a list of the logs and of all the documents from stations abroad received at the Office during the year.

Atlantic Weather Charts.—The investigation of the weather over the North Atlantic Ocean for the 13 months, beginning August 1st, 1882, and ending August 31st, 1883, has during the past year employed nearly the whole Marine Branch of the Office. Synchronous weather charts.

It will be remembered that the above-named period is that during which the International System of Circumpolar Observations has been carried out.

Steady progress has been made in preparing the data and plotting them on daily charts. Already 10,502 monthly forms have been received from 2,563 ships, giving an average of 808 forms for each of the 13 months. The following statement shows the distribution of the data over the several months:—

TOTAL NUMBER of FORMS received for each MONTH, to March 25th 1884.

1882—	August	823
	September	878
	October	927
	November	856
	December	843
1883—	January	771
	February	812
	March	857
	April	874
	May	817
	June	706
	July	694
	August	644
	Total	10,502

Synchronous weather charts.

Observations, on an average, at more than 400 positions are obtained for each day's chart. This average, however, does not include observations for each day from about 100 land stations, which are recorded on the charts to establish a connexion between the land and sea.

Full details of the system adopted for carrying out this investigation will be found in the Report for 1883; but the principal features of the method may conveniently be here repeated:—

"The charts are drawn upon the conical projection, which affords the best means of indicating the true relative directions of the winds and lines of equal pressure and temperature to one another and to the meridian. The working charts are drawn on sheets of double-elephant paper, and extend from the Equator to Lat. 75° N., and from Long. 100° W., to Long. 20° E., the meridian of 40° W. being in the centre. The scale is about 180 nautical miles to the inch.

"As it was important that the demands made on the observers should be no more than was strictly essential, it was decided to ask only for observations at 8 a.m. and noon, local time, at which hours the required data of barometric pressure, temperature, and wind direction and force are usually recorded in a ship's log. From these the necessary corrections to reduce the data to Greenwich noon are readily made by interpolation with sufficient exactness for the objects in view.

"The question of the time to be followed in recording the observations on the charts, whether it should be Greenwich noon or local noon, the former implying that the observations would be truly synchronous, and the latter that they would correspond to the time of the sun's coming to the local meridian, received careful consideration. The conclusion arrived at after examining the methods employed by other authorities in dealing with such investigations (including the charts recently prepared by the Deutsche Seewarte, which were obligingly forwarded for their inspection by Dr. Neumayer), was to enter on the chart the barometer reading and wind for Greenwich noon, thus making the values truly synchronous, but to enter the thermometer reading for local noon, as well as the difference of temperature between local noon and 8 a.m. local time, from which the temperature at Greenwich noon may be estimated by interpolation if required.

"As the diurnal (periodic) variations of pressure in the area dealt with are comparatively small, it was considered that they would probably have but small influence in determining the directions of the wind, or the movements of aërial disturbances across the Atlantic. But local noon on the western side of the charts in Long. 75° W. is about six hours later (absolutely) than local noon on the extreme east of the charts in Long. 20° E., and the disturbances and wind-systems usually move from west to east, and often with considerable rapidity. The conclusion was therefore come to that the observations of pressure to be represented should be truly synchronous.

"In the case of temperature the conditions differ materially from those affecting pressure. The diurnal changes of temperature, though not great, would, if synchronous observations at Greenwich noon were used, introduce an appearance of permanent higher temperature to the east as compared with the west, as such observations in the extreme west would be made five or six hours before local noon, while those in the extreme east would be one or two hours after local noon; a difference of temperature which would not have any true physical significance so far as probable consequent changes of pressure or general weather were concerned. Consequently it was determined to adopt the temperature at noon, local time, for entry in the charts. Provision, however, is made for the consideration, if occasion should require, of the synchronous temperature, by the entry on the chart of the difference between the readings at 8 a.m. and noon, local time, as before stated." Synchronous weather charts.

The process of dealing with the data, which has been arrived at after many preliminary trials, may be briefly stated as follows:—

The forms (of which a specimen is given in Appendix Ia. of the Report of 1883) were distributed freely to ships of the Royal Navy, through the kind co-operation of the Lords of the Admiralty; and to the Merchant Service, through various local marine board and shipping offices under the Board of Trade, but chiefly through direct communication with owners, captains, and officers of ships.

The collection of data has been supplemented by sending an experienced clerk to visit ships and make extracts from their logs.

By these means, observations, probably at more than 400 positions, will be collected for each day's chart, as before stated.

After correcting the observations for instrumental errors, &c., they are reduced to Greenwich noon, where necessary, by interpolation, and the results entered on a large chart on double-elephant paper, upon the conical projection, extending from the equator to 8° N. and from 130° W. to 40° E.

Tracings are then made on four separate sheets from the charts of each day of the entries of pressure, air temperature, sea temperature, and important weather observations respectively, and upon these tracings isobaric lines, isotherms of air and sea, and the outlines of important weather-areas are drawn, and the isobars and isotherms are then transferred back to the original large charts.

After the isobars are drawn on the large charts, arrows are drawn representing the direction and force of the wind, as well as the occurrence of squalls, every care being taken to combine the actual directions observed, with the least possible modification, in relation to the barometrical pressure and the general direction of the winds in the several parts of the charts.

The charts thus prepared will constitute the permanent records of the original data, as well as of the isobars, isotherms, and generalized winds. They are, however, too complicated and too large for publication; the Council, therefore, contemplate the

Synchronous weather charts.

publication of the results in two reduced charts, of which Plates I. and II. are specimens, the reductions being produced by an eidograph.

These charts will show the isobaric lines, isotherms of air and sea, the direction and force of wind, together with graphic indications of areas of rain, fog, and mist.

It has, however, become manifest that much time must elapse before all the necessary data are collected and plotted on the charts, and this work must be completed before the discussion can commence.

The charts for August, September, and October 1882 are nearly ready for reduction, but they cannot be finally dealt with until observations from all the circumpolar stations included on the chart have been received.

The Council are most grateful to the owners, captains, and officers of ships for their willing and able help in the work. Not only have Englishmen given their willing aid, but a large amount of excellent data has been sent in by the heads of Foreign meteorological offices, especially from the several circumpolar observing stations on the shores of the Atlantic Ocean, and by the captains and officers of foreign ships. The visiting clerk employed by this Office has also obtained much valuable information from foreign ships, whose captains and officers have received the clerk most kindly, lent him their logs, and given him all the aid in their power.

Sea surface temperature charts.

Sea Surface Temperature Charts.—This work has now been completed and published.

The series of charts are for the four cardinal months of February, May, August, and November, which are taken to represent the four seasons of sea surface temperature. In addition four smaller index charts are given, representing for the entire ocean, the lines of equal temperature (isotherms) in the four months above mentioned.

Whenever the sea is frozen, as in the month of February in high northern latitudes, the temperatures given on the charts are those of the air.

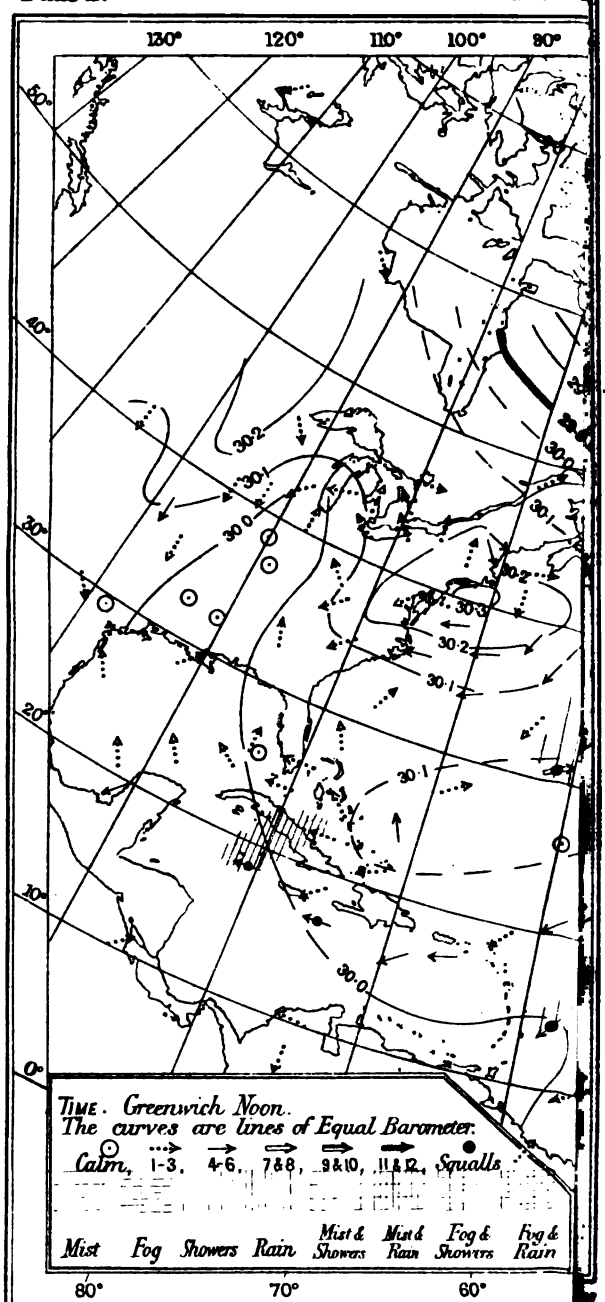
The authorities from which the material used in preparation of the charts have been derived are (1) the logs, &c. in the Office (2) the remark books of the Royal Navy, (3) the records of the most famous Arctic and exploring voyages of both British and foreign navigators, (4) the various publications on maritime meteorology which have from time to time appeared in the United States and in Europe.

The number of M O. logs which were used in the discussion were for the

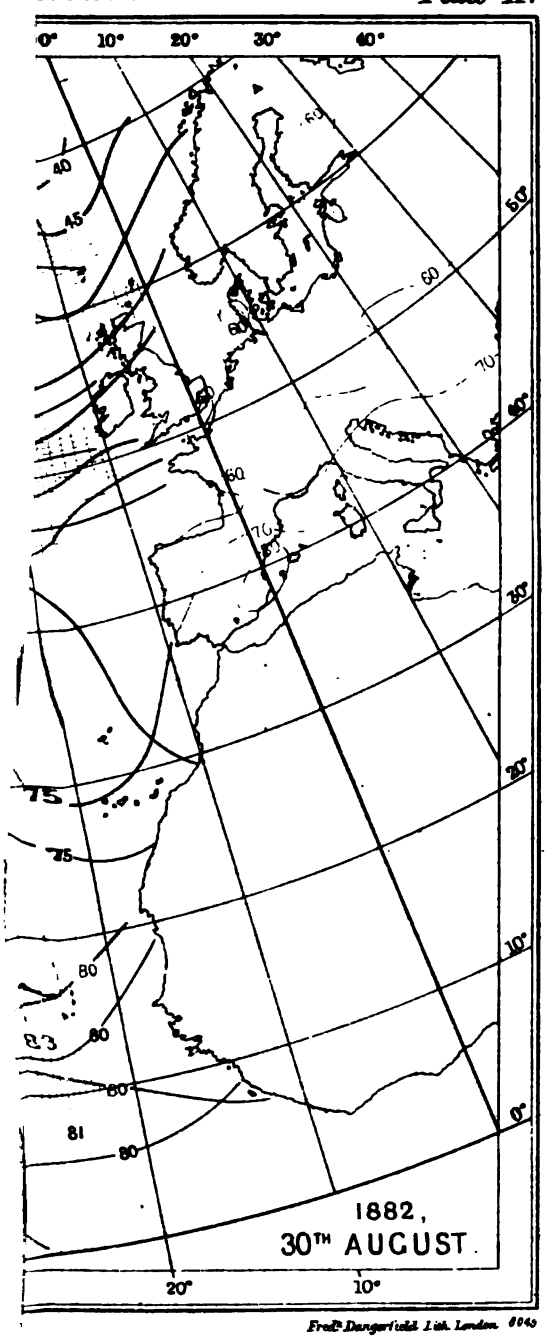
Atlantic Ocean		3,859
Indian	„	1,849
Pacific	„	770

And an estimate of the amount of material actually employed may be formed from the fact that for the Atlantic Ocean alone and for the month of August (which has been taken as a specimen), 80,000 observations were discussed.

Plate I. BARO


130°
120°
110°
100°
90°
80°
70°
60°
50°
40°
30°
20°
10°
0°
30·2
30·1
30·0
30·3
TIME. Greenwich Noon.
The curves are lines of Equal Barometer.
Calm, 1-3, 4-6, 7&8, 9&10, 11&12, Squalls
Mist
Fog
Showers
Rain
Mist & Showers
Mist & Rain
Fog & Showers
Fog & Rain

ATHER. *Plate II.*



Fred. Dangerfield Lith. London. 1882

Charts of Barometrical Pressure over the Oceans.—These charts are in an advanced stage, three months of the series have been completed as regards the collection and entry of observations for all the oceans, and it is contemplated that the whole of this work will be finished by the end of the year 1884. The deficiency of material over certain unfrequented regions in the Pacific and Southern Ocean has rendered the drawing of isobars somewhat difficult, and the final preparation of the charts for the engraver has consequently been retarded. Charts of barometrical pressure.

Contributions to our Knowledge of the Meteorology of the Arctic Regions.—Three parts of this work have already appeared. The preparation of Part IV. has been found to occupy longer time than was anticipated, owing to the mass of materials from the last British Expedition, under Sir G. Nares, and from the "Polaris" expedition of the United States Government. Arctic meteorology.

The Circumpolar Observations.—The objects of the British expedition which was mentioned in the last Report, though it was not in any direct connexion with the Meteorological Council, were successfully carried out by the maintenance at Fort Rae, on the Great Slave Lake, of a complete series of observations in meteorology and magnetism for a full year. Captain Dawson, R.A., and his assistants left Fort Rae on the 1st September 1883, and reached England November 20th. The observations are in process of discussion and will be published by the Circumpolar Committee of the Royal Society. Circumpolar observations.

The Barometer Manual for the Use of Seamen.—This work, which, as explained in the last Report, has been prepared at the request of the Board of Trade, has now appeared. It is divided into the following sections: the Barometer and Method of using it; Barometric Pressure; Variations of Pressure; Winds, their Causes and Distribution; Winds and Storms of the Temperate Zones; Tropical Storms. The Barometer Manual for the use of Seamen.

The whole forms a book of 41 pages, and is illustrated by woodcuts and specially prepared charts of barometric pressure and wind.

Supply and Stock of Instruments.—In Appendix IV. (p. 46) will be found a list of the meteorological instruments supplied by the Office to ships in the Royal Navy during the year, with a statement of the entire stock and distribution of instruments standing on the books, to the account of the Admiralty, on the 31st March 1884. Instruments belonging to the Office.

Appendix V. (p. 47) gives similar information with regard to the disposal of the other instruments belonging to the Office, which are mainly supplied to the Mercantile Marine.

PART II.

Weather Telegraphy.

Reporting stations.

Telegraphic Reporting Stations.—The service has not been carried on without interruptions during the year now under review, any more than during its predecessors. The breaks in communication have not, however, been very serious or protracted.

Some important changes in the arrangements for the receipt of of intelligence are now in progress. First may be noticed the recent extension of telegraphic communication to Belmullet, on the extreme north-west corner of the Co. Mayo, in Ireland. The Council have succeeded in finding an observer in this remote locality, and a station will soon be established there. It lies nearly 80 miles westward of Mullaghmore, the station now reporting on the coast of Donegal Bay.

It is in contemplation to organize another station on Malin Head, the extreme north point of Ireland. The Committee of Lloyd's have recently established a signal station, provided with telegraphic communication, on this headland, and have most liberally offered the Council permission to avail itself of the facilities thus afforded for the improvement of the telegraphic system. The Council have gladly acceded to the proposal, and the station will be organized in the coming summer.

The Council have it also in contemplation to substitute Dungeness for Dover as a reporting station. The former station lies on a low spit of land, well exposed to the wind from all points, and thereby offers a strong contrast to Dover, which lies immediately under high cliffs, and is therefore entirely sheltered from all land winds.

In the last Report it was stated that possibly hand anemometers might be supplied to some stations, and two specimen instruments of this character have been constructed, and are now in process of being tested, by the permission of the Elder Brethren, at two of the Trinity House Stations.

Changes in the staff.

A list of the telegraphic reporters will be found in Appendix VI. (p. 48). The only change during the year has been at York, where Mr. H. M. Platnauer has succeeded Mr. Keeping as Curator of the Museum.

Inspection of the stations.

Inspection of the Reporting Stations.—The reporting stations have been inspected during the year, in England (including Jersey and the Isle of Man) by the Rev. W. Clement Ley; in Scotland by Mr. Buchan; and in Ireland and Wales by Mr. Scott. The reports submitted by the Inspectors to the Council, which are printed in Appendix VII. (p. 49), show that the efficiency of the service has been fairly maintained.

Discussion of the reports.

Discussion and Publication of the Information received.—A description of the practice of the Office in the collection, discussion, and dissemination of the meteorological information received by telegraph is given in Appendix VIII. (p. 61). A list of the institutions and persons who received the Daily Weather Reports and Charts free of cost in 1883–4 forms Appendix IX. (p. 70).

Forecasts.

Weather Forecasts.—There has been no material change in the system of preparation and issue of the forecasts during the year.

Forecasts are issued twice a day, at 11 a.m. and at 8h. 30m. p.m. The Forecast prepared at 11 a.m., on the information derived from the 8 a.m. reports, refers to the probable weather between noon on the day of issue and noon on the day following, and is publicly posted up in several places in London,* and supplied to the afternoon editions of the newspapers.

Inquiries at the Office.

Owing to the additional information afforded to the public by the appearance in so many of the daily papers of the Forecasts now prepared, the number of special inquiries has been small. The inquiries received through the Post Office during the year amounted to 76, and the personal applications to 34. The rules of the Office relating to such inquiries continue the same as in previous years, and are given in Appendix VIII.

Testing of the forecasts.

The results of a comparison of the Forecasts issued at 8 p.m. during the year with the weather actually experienced is given in Appendix XII., p. 76, and the following summary of successes and failures, estimated in the manner explained in that Appendix, shows that the average of success over the whole United Kingdom has been 81 per cent., being an improvement of 2 per cent. on the figures for the previous year:—

SUMMARY OF RESULTS.

Districts.	Percentages.				Total percentage of Success.
	Complete Success.	Partial Success.	Partial Failure.	Total Failure.	
SCOTLAND, N. - -	49	33	11	7	82
„ E. - -	50	31	10	9	81
ENGLAND, N.E. - -	50	31	11	8	81
„ E. - -	48	36	10	6	84
MIDLAND COUNTIES -	49	34	10	7	83
ENGLAND, S. - -	52	32	9	7	84
SCOTLAND, W. - -	42	35	13	10	77
ENGLAND, N.W. -	44	35	13	8	79
„ S.W. -	47	35	11	7	82
IRELAND, N. - -	52	30	10	8	82
„ S. - -	47	32	10	11	79
Summary - -	48	33	11	8	81

* Viz., in the City, at the Mansion House, at Lloyd's Rooms, and at Messrs. R. & J. Beck's, Cornhill, and at Messrs. Thos. De La Rue & Co., Bunhill Row; in the West End, in the Libraries of the House of Lords and House of Commons, at Messrs. Elliot's, Strand, Messrs. Stanford's, Charing Cross, Messrs. Negretti & Zambra's, Regent Street, and Messrs. Pastorelli's, New Bond Street.

Hay Harvest Forecasts.

Hay Harvest Forecasts.—The Council renewed in 1883 the offer made in the three previous years to the Royal Agricultural Society, the Royal Dublin Society, and the Highland Society to send daily Forecasts *gratis* during the hay season to a number of observers selected by the Councils of those Societies, on the two conditions, that the information should be made as widely known as possible, and that a record should be kept of the value of each prediction and sent in weekly to the Office. The Societies again cordially accepted the proposal, and the following list of recipients was prepared:—

LIST of those who received HAY HARVEST FORECASTS in 1883.

Districts.	To whom sent.	Address.
0. SCOTLAND, N.	Rev. Dr. Joass	Golspie.
	Major Smith	Munlochy, Inverness.
1. SCOTLAND, E.	G. Johnstone	Glammis, by Forfar.
	W. S. Macdonald	Craigielaw, Longniddry.
2. ENGLAND, N.E.	J. Wilson	Chillingham Barns, Belford, Northumberland.
	J. Turner	The Grange, Ulceby.
3. ENGLAND, E.	W. Birkbeck	High House, Thorpe, Norwich.
	Sir J. B. Lawes, Bt., and J. H. Gilbert, Ph.D.	Rothamsted, Harpenden.
4. MIDLAND COUNTIES	Royal Agricultural College.	Cirencester.
	The Duke of Somerset	Gerrard's Cross, Bucks.
5. ENGLAND, S.	C. Whitehead	Barming House, Maidstone.
	E. P. Squarey	The Moot, Downton, Wilts.
6. SCOTLAND, W.	W. Calder	Castle Hill, Dalreoch, Dumbarton.
	M. J. Stewart	Ardwell, Stranraer.
	J. S. R. Ballingal	Eallabus House, Islay.
7. ENGLAND, N.W.	G. W. Wray	Leyburn, Yorkshire.
	The Earl of Derby	Knowsley Hall, Prescott.
	The Lord Egerton of Tatton.	Tatton Park, Knutsford.
8. ENGLAND, S.W.	Colonel J. B. Turbervill	Ewenny Priory, Bridgend, Glamorgan.
	The Earl of Ducie	Whitfield, Falfield, R.S.O.
	T. Dyke	Long Ashton, Clifton, Bristol.
	R. Neville	Butleigh Court, Glastonbury.
9. IRELAND, N.	Viscount Massereene and Ferrard.	Antrim Castle, Antrim.
	Rev. A Brown	The Manse, Hollymount, Co. Mayo.
	C. Cole Hamilton	Cherrymount, Moynalty, Co. Meath.
10. IRELAND, S.	D. A. M'Cready	Larchvale, Moneygall, King's Co.
	D. A. Milward	Lavistown, Kilkenny.
	W. Talbot Crosbie, D.L.	Ardfert Abbey, Tralee, Co. Kerry.

The general result of this repetition of the experiment of 1879 is shown by the subjoined table, which has been compiled solely from the reports of the above-mentioned gentlemen, and is entirely independent of any estimate formed within the Office itself:— Hay Harvest Forecasts.

SUMMARY of RESULTS.

Districts.	Names of Stations.	Percentages.				
		Complete Success.	Partial Success.	Partial Failure.	Total Failure.	Total percentage of Success.
SCOTLAND, N. -	Golspie and Munlochy - - -	45	38	12	5	83
„ E. -	Glammis and Longniddry - -	63	32	3	2	95
ENGLAND, N.E. -	Ulceby and Chatton, Northumberland	70	23	7	—	93
„ E. -	Thorpe and Rothamsted - -	53	33	10	4	86
MIDLAND COUNTIES	Cirencester and Gerrard's Cross -	40	45	13	2	85
ENGLAND, S. - -	Maidstone and Downton - -	56	34	6	4	90
SCOTLAND, W. -	Islay, Dumbarton, and Stranraer -	55	36	9	—	91
ENGLAND, N.W. -	Leyburn, Prescot, and Knutsford -	64	29	7	—	93
„ S.W. -	Bridgend (Glamorgan), Falfield, Clifton, and Glastonbury.	41	39	15	5	80
IRELAND, N. - -	Antrim, Hollymount, and Moynalty -	47	38	14	1	85
„ S. - -	Moneygall, Kilkenny, and Ardfert Abbey (Tralee).	51	37	9	3	88
	Mean for all districts, 1883 - -	53	35	10	2	88
	„ „ 1882 - -	50	37	11	2	87

Remarks:—The result of the checking shows that the general percentage of success (88) and also the proportion of completely successful forecasts is higher than even that of last year. The largest percentages were reached in Scotland, E., England, N.E., and England, N.W., the values being 95 and 93 respectively, while the smallest proportion of good forecasts (80) was in England, S.W.

Major Smith (Scotland, N.) says that the forecasts were very correct on the whole, particularly those from the 24–29 July, the forecasts on those days being "wonderfully correct."

Mr. W. Downing (England, S.W.) in a letter to Mr. Neville, remarks "the weather reports have been in great request in this "neighbourhood."

Storm Warnings for the Coasts of the United Kingdom.—In Appendix XI. (p. 74) will be found the names of the stations which are furnished with signals for Storm Warnings, in accordance with Circular 717 of the Board of Trade issued in February 1874. Storm warnings.

Results of storm warnings in 1883.

These stations were, at the end of March 1884, 139 in number, situated :—

68 in England, 13 in Wales, 37 in Scotland, 15 in Ireland, 3 in the Isle of Man, and 3 in the Channel Islands.

The usual comparison has been instituted in the Office between the warnings issued in 1883 and the weather experienced on our coasts, the warnings being tested by the method explained in Appendix VIII. The results of the comparison are shown in the following tables:—

RETURN of the Result of the Comparison between the Warnings issued and the Weather experienced in 1883.

Coasts.	Total No. of Orders to hoist and repetitions.	Warnings justified by subsequent Gales. Force 8 and upwards.	Warnings justified by subsequent strong Winds. Forces 6 and 7.	Warnings not justified by subsequent Weather.	Warnings late. Force 9 reached at two Stations before issue.	Warnings partially late. Force 9 reached at one Station before issue.	Warnings in Error owing to Telegraphic mistakes.	Storms for which no Warning was issued.
Ireland, South -	66	34	14	16	—	2	—	
„ East -	75	40	16	19	—	—	—	Mar. 6.
Scotland, East -	82	55	16	11	—	—	—	Feb. 22, Mar. 6, Mar. 17, Oct. 25.*
„ West -	61	30	15	14	1	1	—	
England, North-west	69	43	5	21	—	—	—	Mar. 7.
„ West -	61	30	13	18	—	—	—	
„ South -	84	52	20	11	—	—	1	Mar. 6, Aug. 10, Nov. 4.
„ South-east	44	22	13	7	—	2	—	Mar. 6.
„ East -	68	37	20	10	—	1	—	
Totals - -	610	343	132	127	1	6	1	
Per-centages -	—	56·2	21·6	20·8	0·2	1·0	0·2	

* Storms on the East Coast of Scotland marked thus were only felt North of Aberdeen.

Comparison of results for 1883 with previous years.

The following table contains a comparative statement of the storm warnings and their results in 1883 and in the ten preceding years. It will be seen that the percentage of warnings justified is somewhat less than in the previous year :—

Years.	Total No. of Warnings issued.	Warnings justified by subsequent Gales.	Warnings justified by subsequent strong Winds.	Total Warnings justified.	Warnings not justified by subsequent Weather.
1873	250	45·2	34·0	79·2	16·8
1874	317	45·4	32·8	78·2	16·4
1875	248	41·1	35·1	76·2	21·0
1876	265	61·1	21·5	82·6	11·7
1877	475	53·3	25·9	79·2	16·4
1878	485	56·7	20·8	77·5	17·9
1879	509	50·5	25·1	75·6	20·6
1880	390	58·2	24·6	82·8	13·3
1881	454	58·6	23·3	81·9	14·8
1882	503	61·4	21·1	82·5	14·9
1883	610	56·2	21·6	77·8	20·8

Remarks.—Of the storms for which no warning was issued only one was severe, that of March 6, which caused serious loss of life and property in the North Sea. The conditions under which it occurred were very unusual, and it came on very suddenly. Moreover, as most of the fishing boats which felt its effects had been absent from port two or three days, any warning sent to the ports could not have been conveyed to them. Storms for which no warnings were issued.

A return of all gales since 1873, of which no warnings were issued from the Office, has been called for by the House of Lords and will shortly be completed. This will supply full information on the circumstances under which these gales were left without notice.

Fishery Barometers.—In connexion with the subject of storm warnings, the supply of public so-called "fishery" barometers to the coast may be mentioned. The whole number of stations on our coasts supplied with these instruments by the Office is at present 168, being seven in excess of the previous year. Of these stations, 58 are in England, 5 in Wales, 47 in Ireland, 54 in Scotland, 3 in the Isle of Man, and 1 in Jersey. The list is given in Appendix X., p. 73. Fishery barometers.

Observations on Ben Nevis.—The observatory established under the auspices of the Scottish Meteorological Society at the summit of Ben Nevis, at the height of 4,000 feet, was completed in the course of the autumn of 1883, and the observing staff took up their residence there and commenced operations in the month of November. The Council have again contributed 100*l.* towards the cost of maintaining the observatory during the past year. They have not yet resolved that it will be desirable to obtain daily telegrams from the station, but they have received a few special telegrams from it; it has not, however, as yet been found that these have given earlier intimation of the approach of storms or changes of weather than has been obtained from the other telegraphic reporting stations. Observations on Ben Nevis.

Publications.—There has been some change made in the form of the Weather Reports issued by the Office, with a view to rendering them more uniform in size, and avoiding repetition in the statements they contain. In the last Report it was stated that a plan for supplying a progressive weekly record of various climatic factors was in contemplation. This scheme has now been partially carried out, and since the commencement of the year 1884, the records of Accumulated Temperature, Rainfall, and Bright Sunshine, since the 1st of January, have been inserted. The term "Accumulated Temperature" is employed to designate the amount and duration of the excess of the daily temperature above 42° F., measured in units of one degree continued for 24 hours. The mode of calculating the accumulated temperature is explained at length in a paper by the Chairman, General Strachey, which appeared in the Quarterly Weather Report for 1878, and the substance of which is briefly stated in Appendix VIII. Publications.

This information is given in the Weekly Weather Report, which has been enlarged to quarto size. The additional space thus given has been utilised to give a chart for the pressure and wind at 6 p.m., in addition to that for 8 a.m. before given.

The averages used for determining the variations of each week from the mean have been modified, and are those given in the following publications of the Office:—

Temperature, 20 years, 1861–80, from the Meteorological Atlas of the British Isles.

Rainfall, 15 years, 1866–80, from the Rainfall Tables of the British Isles.

The Daily Weather Report has also been altered from folio to quarto size, so as to be uniform with the foregoing publication. New averages of Pressure, Temperature, and Rainfall have been calculated for 22 stations.

The Monthly Weather Report.

Lastly, the publication of a Monthly Weather Report has been undertaken, in substitution for the Quarterly Report. It was stated in the last Report that the preparation of the engraved plates from the observatory records would be discontinued with the year 1880, and consequently the Quarterly Weather Report became more completely and exclusively a review of the information collected and discussed by the Telegraphic Department of the Office than was previously the case. The Weekly Weather Report in its new form will contain a complete series of Weather Charts, and their reproduction would be useless. The Council have decided to substitute a Monthly for the Quarterly Report, and to issue it as speedily as possible after the termination of the month to which it refers, and this publication has now commenced. With it will be published from time to time in the form of Appendices such special papers or reports as have hitherto formed part of the Quarterly Reports. These arrangements will lead to the publication of the reports from the Observatories and the Stations of the Second Order in a separate volume.

Simultaneous observations.

Simultaneous Observations.—The Office has continued its co-operation with the system of simultaneous observations, taken once in every 24 hours, which was organized ten years ago at the request of the Chief Signal Office of the United States.

The list of observers at land stations for 1883 is given in Appendix XIII., p. 81.

A form for the entry of the simultaneous observations is bound up with every ship's log issued by the Office.

In previous Reports it has been stated that the Lords Commissioners of the Admiralty had, at the request of the Council, issued instructions for these observations to be taken (in addition to those made by the Service Regulations) on board each detached ship-of-war on foreign service; or, in the case of a squadron acting together, on board the ship of the senior officer. The number of these returns which have been received during the year from the Royal Navy has been 6,340, and from the Mercantile Marine, 5,300.

PART III.

Land Meteorology of the British Isles.

Observatories and Stations.—Records of the climate of the British Isles are received by the Office from stations with different degrees of fulness of organisation, which may be arranged in five classes.

Self-recording observatories.

1. The Observatories furnished with self-registering instruments by which all the principal meteorological phenomena are recorded continuously, and which thus afford materials for the study of the periodic variations of the meteorological elements.

Anemographic stations.

2. Anemographic stations furnished with instruments registering the wind only. The records from these stations relate to weather as distinguished from climate, and are especially useful in connexion with the passage of storms, and as affording evidence available in the courts of law with respect to collisions at sea, and damage done by wind.

Stations of Second Order.

3. Stations of the Second Order furnishing climatological information from eye observations taken twice a day. The observers at these stations are all volunteers.

Telegraphic Reporting Stations.

4. The Telegraphic Reporting Stations at which eye observations are taken, forming the material upon which the daily weather reports and forecasts are based. The hours of observation at these stations are limited by the requirements of the telegraphic system, as explained in Part II., but the data which they furnish are utilized to afford climatological information for parts of the country where Stations of the Second Order do not exist.

Extra stations.

5. Extra stations furnishing returns with less completeness, and with less detail than those of class 3.

A detailed account of these several stations and of the methods employed by the Office in dealing with the records they respectively furnish will be found in Appendix XIV., p. 82.

Documents received.

Appendix XV., p. 87, contains a list of all documents relating to the land meteorology of the British Isles received at the Office during the year.

Changes in the observatories.

As stated in the last Report, intimation was sent at the end of 1882 to the authorities at four of the observatories that the annual grant to the stations would cease after 1883. In the case of Falmouth, it was, however, subsequently arranged that if the Royal Cornwall Polytechnic Society would erect an observatory in a suitable locality, instead of the present building whose situation is very unsatisfactory, the annual grant should be continued.

At Stonyhurst the authorities of the College are maintaining the observations. At Glasgow there is a prospect of the records being kept up by the supply of funds from local sources. At Armagh there is no possibility of any such arrangement, but that station will be maintained hereafter by the Office as one of the Second Order.

The minute of the Council on which these conclusions were adopted will be found at Appendix XVI., p. 91.

Inspection of the stations.

Inspection of the Stations.—The self-recording observatories and the anemographic stations (Classes 1 and 2), as well as the Telegraphic Reporting Stations (Class 4), are regularly visited each year by the inspectors of the Office. The extra stations (Class 5) are inspected as opportunity offers. Of the Stations of the Second Order (Class 3), some belong to the Royal Meteorological Society; these are visited by an inspector appointed by the Society, an allowance being made by the Office toward the cost of the inspection, in accordance with the recommendation of the Treasury Committee (1877). The remaining Stations of the Second Order, which are in immediate connexion with the Meteorological Office, are visited at least once in every two years by the inspectors of the Office. The Superintendent of the Kew Observatory, Mr. G. M. Whipple, is especially employed to inspect and report on the self-registering apparatus, and on the photographic processes at the observatories. Extracts from the Reports of the inspectors of the Office and of Mr. Baker, who was charged with the duty of inspection during Mr. Whipple's illness in the summer of 1883, will be found in Appendix VII., p. 49.

Reports supplied to Registrar General for Ireland.

Information supplied to the General Register Office, Ireland.—Reports from nine of the Irish stations of the Office have been regularly supplied to the Registrar General for Ireland, for use in his Weekly and Quarterly Returns.

Quarterly Weather Report.

Quarterly Weather Report.—The engraving of the plates showing the photographic curves of the seven observatories was completed in the course of the autumn, and, as already intimated, this work has been discontinued. Parts III. and IV., completing the volume for 1876, have now been issued.

The publication of the Hourly Readings from the seven observatories has been continued, and the volume for the year 1882 is in an advanced stage.

This volume differs from that for 1881 in that it contains the daily extremes of barometrical pressure, the daily range of the barometer and dry-bulb thermometer, and the total daily rainfall.

The tables of monthly and five-day means from the observatories, which have hitherto appeared in the Quarterly Weather Report, will be issued with the Hourly Readings in future.

Stations of the Second Order

Reports from Stations of the Second Order.—The volume for 1880 is in the press. Considerable delay has arisen in the production of the results for this year, inasmuch as it was thought desirable to include among the stations from which observations are published some of those under the direction of the Scottish Meteorological Society, returns from which the Council of that Society has consented to supply to the office for publication. These stations are *Dunrobin Castle, Braemar, Dundee, Rothesay,* and *Pinmore* (Ayrshire) the observations commencing with the year 1880. The schedules were not received until the autumn, so that the completion of their discussion could not be effected until the year was far advanced.

The arrangements under which this information is supplied are similar to those which have existed for the last ten years, with the Royal Meteorological Society, and which are fully detailed in the Report of the Meteorological Committee for 1874.

The Harmonic Analyser.

The Harmonic Analyser.—The work effected with this instrument during the year has been, in the first place, the completion of the reduction of the records of pressure for the year 1876. The following extract from a report by Professor Stokes on the results of this work, will show the degree of accuracy attained.

"The height of the barometer for each month of the year 1876, and for each of the seven self-recording observatories, has been expressed as a function of the time of day in a harmonic series to three orders, by numerical calculation in the usual way, from the data furnished by the hourly means. The coefficients got in this manner show a very close agreement with those obtained by means of the machine. The coefficients of the variable terms, which have been calculated to four places of decimals, agree so well that the average difference is only about the thousandth of an inch. The comparison does not furnish the means of forming a judgment which of the two sets of numbers is the more accurate. The processes are, however, the same as those which had been tested with the thermometer (Report of the Meteorological Council for 1883, p. 27), in which case the calculated coefficients had been deduced from the odd and even hours separately; and the results rendered it probable that the coefficients obtained by calculation were rather the more accurate. But practically the agreement is so close that either set of numbers may be accepted."

On the completion of these barometrical discussions the treatment of the thermograms was resumed, and the curves for the years 1875, 1877, and 1878 have been successively analysed, the constants in each case having been worked out from the indications of the machine.

London fog.

Inquiry into the Causes and Prevalence of London Fog.—The year 1883 having been singularly free from fog, the committee who have kindly undertaken to investigate the subject have not had much opportunity to prosecute their inquiries, but Dr. Russell has carried out two inquiries into the proportion of carbonic acid in the atmosphere, and into the composition of London rain.

Carbonic acid in air.

Carbonic Acid.—The amount of carbonic acid in London air has been determined at intervals during the last two and a half years.

These determinations are divided into two series, one gives the amount of carbonic acid taken at regular intervals irrespective of weather, and the other gives the amount when fog or mist is present. The average amount present in the air of the city is slightly below four parts in 10,000 of air, and this is shown to be rather less than that which has been found in the air of the few other towns which have been examined. Taking the most recent experiments on the composition of purely country air as indicating that the amount of carbonic acid is as low as three parts in 10,000 even then it seems that in the heart of London the average increase

Carbonic acid.

is not considerable. Further the individual analyses show that the amount of carbonic acid is often considerably below this average, usually during bright sunny days. The smallest amount of this gas found was 3·3 parts in 10,000 of air, and this was on the Bank Holiday in August 1883, and as far as experiments have yet been made, the amount present on a Bank Holiday is always considerably below the average.

The second series of determinations relate to the amount of carbonic acid present during a fog, and show how much this gas increases under such circumstances. The average of these experiments is 7·2. The largest amount found was 14·1, and this was during a long continued fog in December 1882. The gradual increase of the gas on this occasion up to this amount is traced; also other cases are given where there has been a very large increase of carbonic acid. Also the rapid disappearance of the carbonic acid with the disappearance of fog is shown.

The increase and diminution of this gas it is pointed out must indicate the coincident variation of the amount of many other impurities in the air. The variation of the amount with the time of year is also shown in the report.

London rain.

On London Rain.—The samples of rain were collected simultaneously at three stations: one in the city at St. Bartholomew's Hospital, one at Hamilton Terrace on the North-west, and one at Hackney on the North-east of London. The collecting of samples was commenced in the autumn of 1882, and has been carried on to the present time. The amount of sulphates and chlorides in the rain has been determined, and it appears that on taking the average of each set of experiments, the rain collected in the city contains twice as much impurity as that in the suburbs. This impurity is essentially of the same kind in all cases.

The samples collected at different times are shown to vary very considerably in composition, but as a rule the variations are not local but extend over the whole district examined. It is seen from the analyses given to what a great extent rain acts as a purifyer of the atmosphere. The analyses made up to the present time indicate that a greater amount of sulphates are present in the summer rain than in winter rain. This apparently indicates that to a large extent the sulphates come from the decay of animal and vegetable matter, and not merely from combustion of coal. The composition of London rain is also compared with that of the country. The rain collected in the city appears to be never acid, but if rain be collected in open vessels which are left exposed for some length of time to the air, it will then be found to be acid. This arises from soot collecting in such rain water. It is further shown that the moisture in air condensed by application of cold contains impurities similar to those in rain, and that this method may be of service in examining the purity of air.

Motion of the upper currents.

Motion of the Upper Currents.—The experiments on this subject by means of shell firing, in order to ascertain the move-

ments of the upper currents, have recently been resumed on a small scale with satisfactory results, and Capt. A. Noble, C.B., F.R.S., who had kindly undertaken their organisation, has been requested to arrange, if it be possible, for a series of these experiments to be conducted under his superintendence for a limited period of, say, three months, in order to test the value of the proposal thoroughly. Motion of the upper currents.

Cloud Photography.—The photonephograph, devised by Capt. Abney, R.E., for the determination of the motion and altitude of clouds has been under trial at Kew. Several good specimens of dual pictures have been obtained, but it has been found that the extent of base available in the vicinity of the observatory is not sufficiently great to afford satisfactory determinations. This subject continues to receive attention, and it is hoped that before long the apparatus will be brought into satisfactory operation. Cloud photography.

Experiments on Hygrometry and Evaporation.—The experiments on Hygrometry which have been entrusted to Mr. W. N. Shaw, M.A. of Emmanuel College, Cambridge, are still in progress. A report on the subject of evaporation has been received from him and will be issued in the Quarterly Weather Report for 1877. Hygrometry and evaporation.

Krakatoa Wave.—On the receipt at the Office in the month of September of the photographic records for the latter part of August, it was noticed that at all the observatories, without exception, peculiar barometrical disturbances had been recorded during the last five days of the month, which were nearly simultaneous, and were unaccompanied by any change of weather. The fact that these disturbances could also be traced in the daily curves published by the Brussels Observatory, and had succeeded, after a short interval, the violent eruption of Krakatoa in the Straits of Sunda on the 26th and 27th of August, led to the suspicion that a connexion existed between these phenomena, and accordingly copies of barograms from St. Petersburg on the east and from Coimbra on the south-west were obtained. On examination, these were found to exhibit similar disturbances of pressure, so that the connexion between volcanic manifestations in the Eastern Archipelago and oscillations of barometrical pressure in Europe became demonstrable. The Krakatoa barometric wave.

The Chairman, General Strachey, suggested what has now been placed almost beyond doubt, that the true explanation of the phenomena, is that they were produced by the passage round the earth of a series of concentric aërial waves travelling at the rate of nearly 700 miles an hour from the place where the volcanic eruption occurred, and returning in the opposite direction after having met at the antipodes of Krakatoa; and that a succession of such waves was three or four times repeated. Records confirming this conclusion have been subsequently obtained from the most important foreign stations at which self-recording barometers were to be found, including St. Petersburg, Vienna, Rome, Berlin,

The Krakatoa barometric wave.

Paris, Coimbra, New York, Washington, Toronto, Cordoba, the South Georgian Islands, New Zealand, Sydney, Melbourne, Zikawei (Shanghai), Tokio, Calcutta, Bombay, Mauritius, and St. Paolo de Loanda.

A paper by Mr. Scott giving a reproduction of the several barograms, with a note by General Strachey giving the numerical calculations for the times of passage of the successive waves over the stations from which the observations were earliest reported, appeared in the Proceedings of the Royal Society, No. 229. A full investigation of all the data will take place as soon as they are in a complete state.

Meteorological Atlas of the British Isles.

Meteorological Atlas of the British Isles.—This work has now appeared.

Periodicity of rainfall.

Diurnal Variation of Quantity and Frequency of Rainfall at the Self-recording Observatories.—Mr. Scott has completed a discussion of the diurnal range of rainfall, both as to frequency and as to quantity at the seven observatories for the ten years 1871–80. As regards the quantity much assistance was derived from Mr. Lovell Squire, formerly Superintendent of the observatory of Falmouth, who had carried out the calculations of the hourly totals for the entire period. The paper will be published as an appendix to the Quarterly Weather Report for 1877. The paper concludes as follows :—

"Summarizing the outcome of the entire investigation, it appears that as regards Quantity there is little regularity in the fall except at Valencia, where there is a decided minimum about 3h. p.m. At the other stations the regular march of the curve is disturbed by heavy showers, but we see that, for instance at Armagh, the hour of minimum at Valencia is characterized by a relative maximum, and this appears to a greater or less degree at several other stations. This would therefore seem to indicate that the phenomenon of the afternoon minimum is proper to the surface of the ocean, as Valencia is more exposed to sea influence than any of the other observatories.

"As regards Frequency, Valencia again is the only place that shows a definite range in all months. Here the greatest frequency of fall, the time that precipitation is most likely to occur, is the early morning, and the driest period of the day is about noon. At Kew, the most continental station, the conditions are reversed, the amount of variation is slight, but the frequency is decidedly greater in the afternoon than during the night hours and the early morning. The maximum in the early morning appears with more or less distinctness at all the observatories except Kew and Armagh."

Electrical anemometer.

Electrical Anemometer.—The difficulties which are met with in finding satisfactory exposure for anemometers at the coast stations has induced the Council to endeavour to establish on a high hill in the Island of Valencia an anemometer to be electrically connected with the observatory. They have received a most

courteous offer of assistance in the completion of the arrangements from Mr. W. H. Preece, F.R.S., of the Telegraphic Department of the General Post Office, and an anemometer is at present being fitted with electrical connections in the workshops of the Postal Telegraph Office, under the personal superintendence of Mr. Preece. Electrical anemometer.

Library.

The library contains standard works on Meteorology and the allied sciences. It consists at present of nearly 8,000 volumes and pamphlets, exclusive of charts and MS. records of observations. The books and other documents are accessible to scientific men. Library.

Appendix XVI. contains a list of the accessions to the library during the year. A few volumes have been purchased.

In conformity with a practice now generally recommended by authorities on bibliography, all books and pamphlets received during the year have been catalogued upon cards, besides being entered in the existing reference catalogues.

Expenditure.

Appendix XVII. shows the receipts and payments during the year ending 31st March 1884. The amount voted by Parliament was 15,300*l.*, as in the previous year. Financial.

The following abstract of expenditure shows the amount properly chargeable to the year in question, and its distribution under the various heads, together with the increase or decrease in 1883–84, as compared with the previous year :—

Net Expenditure.	1882-83.	1883-84.	Increase.	Decrease.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Payment of Council -	1,000 0 0	1,000 0 0	—	—
Secretary - -	800 0 0	800 0 0	—	—
Office salaries - -	746 0 9	742 10 0	—	3 10 9
Rent, fuel, and lighting -	669 1 5	713 17 7	44 16 2	—
Alterations to premises, attendance, and contingencies - -	617 16 3	466 16 2	—	151 0 1
Expenses incidental to International Meteorological Congress -	30 11 10	5 11 3	—	25 0 7
Pensions - -	19 15 4	42 16 4	23 1 0	—
Special Researches -	756 10 3	660 8 8	—	96 1 7
Land Meteorology -	3,948 3 11	3,684 17 7	—	263 6 4
Weather Information -	4,058 14 11	4,026 0 1	—	32 14 10
Inspections - -	509 6 7	525 8 5	16 1 10	—
Ocean Meteorology -	2,409 6 8	2,694 18 1	285 11 5	—
Total - £	15,565 7 11	15,368 4 2	369 10 5	571 14 2

(Signed) Rd. Strachey,
Chairman of the Council.

APPENDIX.

APPENDIX I.

"Collection of Data from Ships."

The method which has been followed by the Office, since its first establishment in 1854 up to the present date, in the collection of information on Ocean Meteorology, has been to supply officers of the Mercantile Marine with a complete outfit of verified instruments, on the condition of their returning the instruments, and the log of observations made with them, to the Office, or to one of the agents mentioned below, at the completion of the voyage.

Every instrument supplied has been originally verified at Kew Observatory, and on the completion of the voyage it is compared with a standard instrument either at the Office or by one of its agents. Under ordinary circumstances it is not requisite to send the instruments to Kew for re-verification after every voyage, as the changes in their errors are generally slight.

The regular outfit of a ship consists of:—

1 Barometer (Kew pattern).
6 Thermometers, with a thermometer screen.
4 Hygrometers.

The first record of observations is made in a Rough Book supplied for the purpose, which is retained by the captain, who copies the observations into a Meteorological Log kept for the Office.

In order to facilitate the communications between the Office and the observers, agencies are established at some of the principal ports, and instruments are supplied directly from such agencies to the ships.

The following is a list of the agents at present in connexion with the Office:—

Aberdeen	J. R. Jones	Navigation School.
Cardiff	Captain Fowler	Sailors' Home.
Dundee	Leonard Allen	Navigation School.
Glasgow	Messrs. D. M'Gregor & Co.	44, Clyde Place.
Greenock	Do. do.	32, Cathcart St.
Hull	Z. Scaping	Trinity House.
Liverpool	J. Gill	Sailors' Home.
Southampton	C. H. Permain	13, Oriental Place.

A set of instruments is kept in working order at the Office in London and at each agency. When a captain expresses himself willing to observe, he is invited to inspect the instruments and learn what will be required of him. If this takes place at one of the agencies, and the captain decides to undertake the work, his name is submitted to the Marine Superintendent, who, if the owners of the ship are British subjects, and she is likely to return to some port in the United Kingdom, sanctions the supply, having due regard to the nature of the proposed voyage and giving preference to captains intending to visit the districts whence the information existing in the Office is scanty.

In a few exceptional cases captains are supplied at ports where there are no agencies, and in these cases the instruments are sent from the Office in London.

Agents receive a fee of 1*l.* 5*s.* for each case of supply and return of instruments, and an additional fee of 1*l.* for the first "excellent" log sent in by any observer whom they may have invited to begin keeping a log, but the Council reserve to themselves the right of deducting the fees for both supply and return of the instruments, if no log is returned, or one which is worthless.

Captains are requested to give notice of their return to any port in the United Kingdom to the agent at the port, if there be one, or else to the Office in London, and steps are then taken to send for the instruments and log. The latter is sent up to London, and the instruments are at once compared with a standard set, and if received at an agency, the results of such comparison are duly forwarded to London.

As regards the Royal Navy, Her Majesty's ships have been supplied by the Office, since its foundation in 1854, with the meteorological instruments used in the service, and for this provision is annually made in the Estimates furnished by the Office to the Treasury upon which the vote for the Meteorological Council is based. The records of observations made by naval officers are in due course deposited at the Admiralty, where they are available for use. It is optional with the observers to keep for the Office a Meteorological Log in addition to the regular record of observations required by the rules of the service. The Council are glad to say that they receive from time to time Meteorological Logs of high value from Her Majesty's ships.

Meteorological Logs received at the Office, whether from Her Majesty's ships or from the Mercantile Marine, are tested according to a definite form (the "test sheet," which has been published in the Report of the Maritime Conference of London, 1874, p. 35), and the observations are classified according to their quality.

As soon as this first testing has been effected, a letter is written to the captain, and if any questions arise to which he can probably give an answer, he is requested to do so while the incidents are fresh in his memory. The replies are noted in the log for future reference.

The method of discussion varies according to the object proposed and the amount of data to be dealt with.

If it is proposed to discuss all the meteorological observations in a given part of the sea, they are first transcribed into data books; an account of the way in which the data books are prepared and used has been given in previous Reports.

If only one element (such as the surface temperature of the sea) is to be discussed, it has been found best to plot the data directly from the logs in geographical position on a chart, and to deduce from the chart means for spaces as small as the number of the observations will allow.

Daily Synchronous Meteorological Observations at 0h. 8m. p.m. Greenwich Mean Time.

In addition to the meteorological logs received from the Navy, owing to the kindness of the Lords Commissioners of the Admiralty, a full set of observations is made at one time each day by all of Her Majesty's ships, in whatever part of the world they may be stationed. These are entered on monthly forms, and forwarded to the Office as soon as possible after the end of each month. Officers of the Mercantile Marine who are keeping meteorological logs, are also invited to co-operate in keeping the synchronous observations, and in numerous instances the observations are well and regularly made. By these means the Council are in early possession of valuable observations which cover, to some extent, the navigable seas of the whole Globe.

APPENDIX II.

LIST of CAPTAINS (and Officers) who have sent in Logs classed as "Excellent" during the year ending March 31, 1884. The figures opposite to each show the total number of such Logs which they have returned to the Office during the period that they have been observing.

Captain's Name.	Number of "Excellent" Logs.	Ship.
Adams, Sub.-Lieut. R. P., R.N.	2	H.M.S. "Dart."
Adamson, John - -	1	"Roman Empire."
Alderton, T. - - -	2	S.S. "Australia."
Baker, Lieut. Henry, R.N. -	7	H.M.S. "Flying Fish."
Balderston, Richd. James -	4	"Belfast."
Balfour, Lieut. Andrew, R.N. -	11	H.M.S. "Magpie."
Ballard, H. - - -	1	S.S. "Durban."
Barlow, A. E. - -	8	S.S. "Paramatta."
Barlow, Brabazon J. - -	1	S.S. "Amarapoora."
Barron, William - -	19	S.S. "Empress."
Bennett, Edwin Charles -	10	"Thessalus."
Blake, Edwin John - -	9	"Tilkhurst."
Bolton, S. H. - - -	3	S.S. "Tyne Queen."
Boothby, George C. - -	1	S.S. "Circassia."
Bourke, Comr. Edmund, R.N., F.R. Met. Soc.	4	H.M.S. "Gannet."
Bristow, W. M. - -	1	"Undine."
Brown, Alfred John - -	10	"Chamois."
Buchan, James - -	14	"Coppename."
Campbell, Archibald - -	12	S.S. "Ethiopia" and S.S. "Circassia."
Campbell, James - -	3	"Florence."
Carpenter, Lieut. Alfred, R.N., F.R. Met. Soc.	10	H.M.S. "Magpie."
Cato, W. R. - - -	6	S.S. "Scotia."
Christie, John D. - -	1	S.S. "Erl King."
Clarke, James - - -	1	S.S. "Olbers."
Cooke, Charles F. - -	1	"The Lord Warden."
Crotty, J. H. - - -	1	"Evesham Abbey."
Crutchley, William Caius, R.N.R.	6	S.S. "Nubian."
Dart, Leonard C. - -	4	"Julia H."
Denham, George - -	3	S.S. "Erl King."
Deuchars, William - -	2	S.S. "Resolute."
Donaldson, James - -	1	S.S. "Bolivia."
Dunbar, John Ivor - -	2	S.S. "Martaban."
Ellery, William - -	14	"Majestic."
England, Thomas - -	1	"Jane."
Freeman, Thomas William -	17	S.S. "Bellerophon."
Gray, David - - -	10	S.S. "Eclipse."
Gray, John - - -	9	S.S. "Hope."
Grey, C., R.N.R. - -	1	"MacMillan."
Grieve, William M. - -	4	"City of York."

Captain's Name.	Number of "Excellent" Logs.	Ship.
Hepworth, Campbell M. W., F.R. Met. Soc.	5	S.S. "Danube."
Holdich, John Peach, R.N.R.	8	"British Envoy."
Hoskyn, Lieut. and Comr. R.F., R.N.	8	H.M.S. "Flying Fish."
Hughes, W. P.	5	"Laomene."
Jeffery, Arthur W.	6	S.S. "Ptolemy" and S.S. "Teniers."
Jones, Edward, R.N.R.	1	S.S. "Drummond Castle."
Jones, S. Griff	4	"Hermine."
Kidley, W. H.	3	S.S. "Coptic."
Ladd, Mr. Richard, F.R. Met. Soc.	8	S.S "Scotia."
Lailey, William Nicholson	4	S.S. "Derwent."
Lawson, James	4	S.S. "Minho" and S.S. "Humber."
Leeper, Lieut. A., R.N.	4	H.M.S. "Lark."
Legg, William	2	"Star of Greece."
Lehman, Charles	2	"Mikado."
McBride, A. C.	1	"Island Belle."
McDougall, A.	1	"Auckland."
Metcalfe, John	7	S.S. "Oceanic."
Milne, W. F.	1	S.S. "Esquimaux."
Molony, E. J.	2	"British Merchant."
Moore, Lieut. and Comr. W. U., R.N.	2	H.M.S. "Dart."
Murray, Alexander	3	S.S. "Windward."
Neale, Mr. W. H., M.B.	1	"Eira."
Nicholson, M.	3	"Simla."
Norman, Francis	2	"Polestar."
Oldham, Lieut. in Command C. F., R.N.	4	H.M.S. "Lark."
Pagan, James	1	S.S. "Tenasserim."
Parry, Moses, F.R. Met. Soc.	6	"Queen of Cambria."
Parsell, Henry	6	S.S. "Baltic."
Parson, Geo. Fry	3	"Earnock."
Pearson, Charles William	22	S.S. "Strathleven."
Peebles, Robert	8	"Tweedsdale."
Piric, Lieut. George, R.N.	1	H.M.S. "Flying Fish."
Pomeroy, H.	1	"Elissa."
Price, J. H.	1	"Viola."
Prout, John Cawse	2	"Cape St. Vincent."
Raeburn, John, R.N.R.	8	"Lochee."
Renaut, Charles Henry	13	"Pleione."
Richardson, Sub.-Lieut. Wyndham, R.N.	4	H.M.S. "Sylvia."
Robinson, Thomas	3	"Chinsura."
Rosseter, William Lawrence	2	"St. Kilda."
Russell, Charles James	3	"Candahar."
Scott, William	13	"Commewyne."
Shearer, George	6	"Corona."
Simpson, Alexander	14	"Traveller."
Smith, Mr. B. Leigh	1	"Eira."

Captain's Name.	Number of "Excellent" Logs.	Ship.
Smith, William Charles -	8	"Her Majesty."
Smith, William Henry, R.N.R.	17	S.S. "Circassian."
Steven, David - - -	2	"Inchkeith."
Stiven, John H. - -	4	"Arethusa."
Strang, Robert - -	1	"Lyttleton."
Tannock, Robert Stewart -	4	"Glencairn."
Thorne, J. W. - -	4	"Falstaff."
Thorpe, J. - - -	1	"Thurland Castle."
Tizard, Staff-Comr. T. H., R.N.	8	H.M.S. "Triton."
Tomlin, P. S. - - -	2	S.S. "Ballaarat."
Turner, E. Wrake - -	11	"Mertola."
Vereker, Comr. Hon. Foley C. P., R.N.	2	H.M.S. "Magpie."
Wait, A. McLean - -	1	S.S. "Spartan."
Walker, Henry - -	2	S.S. "Parthia" and S.S. "Cephalonia."
Whall, William B. - -	1	S.S. "Drummond Castle."
Wharton, W. J. L., R.N. -	12	H.M.S. "Sylvia."
Wight, Henry Potts - -	12	"Oamaru."
Williams, E. M. - -	1	"Burdwan."
Youlden, H. - - -	3	"May Hulse."
Young, Thomas - -	5	"City of Agra."

Names of observers deceased printed in italics.

APPENDIX III.—Ships supplied and Documents returned during the year ending 31st March 1884.

The number of merchant ships supplied with standard instruments and meteorological logs during the above period was 123.

The number of meteorological logs and documents from Foreign Stations received during the same period, and registered in the Office, amounted altogether to 310, of which 179 were returned from ships, and the remainder from land stations, outside the British Isles.

List of Documents received from Land Stations.

Place.	Observer.	No. of Documents.	Nature of Observations.
Abaco (Bahamas) - -	J. Thompson, Lightkeeper -	2	"Lighthouse" Register, February to December 1883.
Barbacena (Brazil) - -	- - - - - -	1	Resumo das observaçoes meteorologicas, March to October 1881.
Barbados (Commercial Hall) -	T. L. Ince - - -	2	"Lighthouse" Register, January to December 1883.
„ (Joe's River House) -	R. B. Walcott, M.D., F.R. Met. Soc.	2	„ „ „ „ „ „
Bermuda - - - - -	Sergt. J. Green, A.H.C. -	5	Anemograms, January 1883 to January 1884.
Beyrout (Lee Observatory) -	F. Nimr, B.A. - -	12	Two observations daily, March 1883 to February 1884.
Borneo - - - - -	- - - - - -	1	Observations at the following stations :—Papar, January 1882 to September 1883; Kudat, November 1882 to June 1883; Sandakan, April to September 1883; Silam, January to June 1883; Elopura, August 1878 to January 1883.
Breaksea Island (King George's Sound).	G. Turner, Lightkeeper -	1	"Lighthouse" Register, January to June 1883.
Cape Juby (North West Africa) -	S. Morris - - -	8	Two observations daily, June 1883 to January 1884.
Cape Pembroke (Falkland Islands)	G. K. Broom, Lightkeeper -	3	"Lighthouse" Register, July 1882 to December 1883.
Cay Lobos (Bahamas) - -	J. M. Avanha and G. L. Nairn, Lightkeepers.	2	„ „ January 1882 to June 1883.
Cay Sul (Bahamas) - -	T. R. Thompson, Lightkeeper	1	„ „ January to June 1883.

LIST of DOCUMENTS—*continued.*

Place.	Observer.	No. of Documents.	Nature of Observations.
Famagusta (Cyprus)	A. H. Moghabghab and S. Photinos.	4	Two observations daily, June, and August to October 1882.
Gibraltar	Sergt. F. Norris, A.H.C.	12	Two observations daily, March 1883 to February 1884.
Great Basses	Lightkeepers	5	Eight observations daily, December 1882, January and February 1883 and September 1883 to January 1884.
Gueluz (Brazil)	- - - - -	1	Resumo das observaçoes meteorologicas, March 1881 to April 1883.
Heligoland	Lightkeepers	8	Eight observations daily, February 1883 to January 1884.
Inagua (Bahamas)	S. W. Hall and J. G. Maura	3	"Lighthouse" Register, July 1881 to May 1882, and July 1882 to December 1883.
Itabira do Campo (Brazil)	- - - - -	1	Resumo das observaçoes meteorologicas, August 1882 to March 1883.
Kyrenia (Cyprus)	E. Joannides	4	Two observations daily, June, and August to October 1882.
Larnaca (Cyprus)	A. Tsepis and G. P. Vondiziano	4	„ „ „ „ „ „ „ „ „
Levuka (Fiji)	J. D. W. Vaughan	5	One observation daily, October 1881 to August 1882.
Limassol (Cyprus)	Luigi Béraud	4	Two observations daily, June, and August to October 1882.
Little Basses	Lightkeepers	6	Eight observations daily, December 1882, January and February 1883, and September 1883 to January 1884.
Nicosia (Cyprus)	D. S. Macnair and A. Kyriakides.	4	Two observations daily, June, and August to October 1883.
Norfolk Island	T. Rossiter	4	„ „ „ January to September 1882.
Papho (Cyprus)	A. H. Moghabghab and E. Malliotis.	4	„ „ „ June, and August to October 1882.
Point King (King George's Sound)	S. Mitchell, Lightkeeper	1	"Lighthouse" Register, January to June 1883.
Santos	- - - - -	1	Monthly rainfall observations, 1871–78.
Sao Paulo (Brazil)	H. B. Joyner, F.R.G.S., F.R. Met. Soc.	10	Two observations daily, February to November 1883.
Sombrero	J. A. Richardson, Lightkeeper	2	"Lighthouse" Register, December 1882 to November 1883.
Suva (Fiji)	J. D. W. Vaughan	4	One observation daily, September 1882 to April 1883.

List of Documents received from Ships.

Captain's Name.	Ship.	Tons.	Owners.	Voyage and Year.	Months of Register.
Adamson, John	Roman Empire	1,542	G. Duncan, London	To Cape Town, Akyab, Table Bay, and home, 1882–83	10
Alderton, T.	S.S. Australia	2,137	P. & O. Steam Navigation Co., London.	One voyage to and from Sydney, viâ Suez, and one to Lat. 11° S., Long. 93° E., 1883	4
" "	"	"	" " "	To Sydney and home, viâ Suez; and one voyage to and from Calcutta, viâ Suez, 1883–84	4
Balderston, R. J.	Belfast	1,865	R. Brocklebank, Liverpool	To and from Calcutta, 1882–83	7
[1] " "	"	"	" "	" " 1883	7
[2] Ballard H.	S.S. Durban	2,875	Union S.S. Co., Lim., London	Two voyages to and from Cape Town, &c., 1882–83	3
[2] " "	"	"	" " "	To and from Cape Town, 1883	2
[3] Barlow, A. E.	S.S. Paramatta	4,759	P. & O. Steam Navigation Co., London.	To Madras, Calcutta, Madras, and home, viâ Suez, 1883	3
[4] " "	"	"	" " "	To and from Sydney, viâ Suez, 1883–84	4
Barlow, B. J.	S.S. Amarapoora	2,464	British and Burmese Steam Nav. Co., Lim., Glasgow.	To and from Rangoon, viâ Suez, 1883	3
Barron, William	S.S. Empress	1,080	W. Bailey, Hull	Trading between Hull and Hamburg, 1883	4
" "	"	"	" "	" " "	3
Bennett, E. O.	Thessalus	1,782	T. Carmichael, Greenock	To Sydney, San Francisco, and home, 1882–83	8
" "	"	"	" "	To and from Calcutta, 1883–84	7
Blake, E. J.	Tilkhurst	1,527	W. R. Price, London	To Singapore, Chittagong, and home, 1882–83	8
Bolton, S. H.	S.S. Tyne Queen	1,264	J. W. Smith, Hull	Two voyages to and from Ports in Spain, 1883	2

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage and Year.	Months of Register.
Bolton, S. H. -	S.S. Tyne Queen -	1,264	J. W. Smith, Hull - -	Three voyages to and from Almeria, Carthagena, &c., 1883 - -	3
" " -	" -	"	" " - -	Three voyages to and from Spanish Ports, 1883–84 - - -	4
Boothby, G. C. -	S.S. Circassia - -	4,272	The Barrow S.S. Co., London -	Five voyages to and from New York, 1883	4
Bouchette, F. B. -	S.S. Montreal - -	3,308	Mississippi & Dominion S.S. Co., Lim., Liverpool.	Two voyages to and from Portland, viâ Halifax; two to and from Quebec, 1883 - - - - -	3
" " -	" - -	"	" " " -	Two voyages to and from Quebec, three to and from Halifax, N.S., 1883–84 -	4
Bourke, Commr. E. G., R.N., F.R. Met. Soc.	Gannet - -	1,130	H.M.S. - - - -	Surveying off the coast of Chile, and in the Straits of Magellan, thence to Monte Video, Sierra Leone, and home, 1883 - - - - -	6
Bristow, W. M. -	Barque Undine -	796	J. R. Kelso, N. Shields - -	To Lat. 41° S., Long. 63° E., 1882 -	3
Brown, A. J. -	S.S. Chamois - -	1,382	W. Jackson, London - -	To and from Jamaica, 1883 - -	2
Brown, E. - -	Barque Moorhill -	484	E. Brown, Liverpool - -	To San Nicolas (River Plate), Pernambuco, and home, 1883–84 - -	4
Brown, James -	S.S. Assyria - -	2,023	T. Henderson, Glasgow - -	One voyage to New York, viâ Halifax, and home; four voyages from Gibraltar to New York, and three home from New York, 1882–83 -	4
Buchan, James -	Barque Coppename -	316	J. C. Pearson, Glasgow - -	To and from Surinam, 1882–83 -	4
" " -	" -	"	" " - -	" " 1883 - -	3
[5] Cameron, J. G. -	S.S. Belgic - -	2,652	Oceanic Steam Nav. Co., Liverpool.	From San Francisco to Yokohama, Hong-Kong, Nagasaki and home viâ Suez, 1883 - - - -	3
[6] Campbell, A. -	S.S. Circassia - -	4,272	The Barrow Steam Ship Co., London.	Five voyages to, and four from, New York, 1883–84 - - -	3

List of Documents, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage and Year.	Months of Register.
Campbell, A.	S.S. Ethiopia	4,005	The Barrow S.S. Co., Barrow	Five voyages to and from New York, 1883	4
Campbell, James	Barque Florence	436	J. T. Cowley, London	To Santos, Philadelphia, and home, 1883	5
[7] Carpenter, Lieut. A., R.N., F.R. Met. Soc.	Magpie	774	H.M.S.	Surveying in China and Japan Seas, 1883	4
[8] Cato, W. R.	S.S. Scotia	4,667	Telegraphic Construction and Maintenance Co., Lim., London.	To and from China, viâ Suez, 1883	4
" "	"	"	" " "	To Hong-Kong, Nagasaki, and home, viâ Suez, 1883	4
" "	"	"	" " "	To and from St. Vincent, 1883	2
[9] Christie, J. D.	S.S. Erl King	2,193	W. Ross, Glasgow	To and from Quebec, 1882	24 days
Clarke, James	S.S. Olbers	2,168	Liverpool, Brazil, and River Plate Steam Navigation Co., Liverpool.	One voyage to Lisbon, Rio Janeiro, New York, and home; one to Lisbon, Rio Janeiro, and New York, 1883–84	4
Clarkson, R. M.	S.S. Ilios	2,020	R. T. Nicholson, Sunderland	To Bombay, viâ Suez, 1883	1
Cooke, C. F., F. Roy. Met. Soc.	The Lord Warden	1,237	H. Green, Blackwall	To and from Melbourne, 1883	6
Crotty, F. H.	Evesham Abbey	1,613	J. Poole, Liverpool	To Sydney, San Francisco, and home, 1883–84	10
Crowell, S. O.	S.S. Alpha	653	W. Cunard, London	Three voyages between Halifax and Jamaica, viâ Bermuda, 1883	2
" "	"	"	" "	Three voyages between Halifax and Jamaica, viâ Bermuda, 1883–84	2
[10] Crutchley, W. C., R.N.R.	S.S. Mexican	4,668	Union S.S. Co., Lim., Southampton	Two voyages to and from Cape Town, 1883	3
[11] " "	S.S. Nubian	3,091	" " "	To and from Cape Town, 1883	2
Dart, L. C.	Barque Julia H.	585	R. C. Haws, St. John's, N.B.	To Jamaica, Apalachicola (U.S.A.), and home, 1883	4

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage and Year.	Months of Register.
Denham, George -	S.S. Erl King - -	2,193	W. Ross, Glasgow - -	One voyage to and from Baltimore, one to and from New York, one to Quebec, 1882–83 - - -	3
" "	" - -	"	" " - -	Four voyages from Quebec to London, three from London to Quebec, one from Havre to New York, and thence to Liverpool, 1883 - - -	4
Deuchars, William -	S.S. Resolute - -	624	Dundee Seal and Whale Fishing Co., Dundee.	To St. John's (Newfoundland), Greenland, and home, 1883 - -	5
Donaldson, James -	S.S. Bolivia - -	2,626	The Barrow S.S. Co., Lim., London.	Three voyages to and from New York, 1883 - - - - -	3
Donaldson, R. A. -	S.S. Glenavon - -	2,985	J. McGregor, London - -	To and from China, viâ Suez, 1883–84 -	3
Dunbar, J. I. -	S.S. Martaban - -	2,517	British and Burmese Steam Navigation Co., Lim., Glasgow.	One voyage to and from Rangoon, viâ Suez, one to Rangoon and back to Lat. 1° N., Long. 83° E., 1883 -	4
" " -	" - -	"	" " " -	One voyage home from Rangoon, and one to and from Rangoon, viâ Suez, 1883–84 - - - -	4
Ellery, William -	Majestic - -	1,884	T. & R. Brocklebank, Liverpool -	To and from San Francisco, 1882–83 -	7
England, Thomas -	Barque Jane - -	636	P. Sutherland, Liverpool - -	To and from Apalachicola, 1883–84 -	3
[7] Evans, Lieut. Hugh R., R.N.	Magpie - -	774	H.M.S. - - - -	At Hong-Kong, 1883 - - -	16 days
Flinton, Benjamin -	Barque Dartmouth -	915	Merchant Shipping Co., Lim., London.	To Lat. 0° S., Long. 30° W., and home from Lat. 0° S., Long. 21° W., 1882–83 - - - -	3
[12] Freeman, T. W. -	S.S. Bellerophon -	1,397	Oceanic Steam Navigation Co., Liverpool.	To and from China, viâ Suez, 1883 -	3
" " -	" " -	"	" " -	" " " 1883–84 -	3

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage and Year.	Months of Register.
Fullarton, D.	Timaru	1,306	Shaw, Savill, and Albion Co., Lim., London.	To Wellington, and home from Newcastle, N.S.W., 1883–84	7
Gordon, John	S.S. Glendevon	1,178	J. P. Lindsay, Newcastle-on-Tyne	To and from New Orleans, 1883	2
Gray, David	S.S. Eclipse	435	D. Gray, Peterhead	To and from Greenland, 1883	5
Gray, John	S.S. Hope	307	R. Kidd, Peterhead	,, ,, ,,	5
Greive, W. M.	City of York	1,195	G. Smith, Glasgow	To Adelaide, Newcastle (N.S.W.), San Francisco, and home, 1883–84	10
Grey, C., R.N.R.	Mac Millan	1,450	J. McMillan, Jun., Dumbarton	One voyage to San Francisco, viâ Cape Good Hope, and home, viâ Cape Horn; one voyage to Bombay, 1881–82	12
Griffin, E. W., R.N.R.	S.S. African	1,258	Union S.S. Co., Lim., London	To and from Cape Town, 1883	2
Hallett, E. O.	S.S. Gaelic	2,652	Oceanic Steam Navigation Co., Liverpool.	Between Hong-Kong, Yokohama, and San Francisco, 1882	4
,, ,,	,,	,,	,, ,, ,,	,, ,, 1882	2
Halley, E.	City of Madras	1,577	G. Smith, Glasgow	To and from Rangoon, 1883	8
Hanslip, W. C.	S.S. Derwent	2,471	Royal Mail Steam Packet Co., London.	To Bordeaux, Lisbon, Brazil, River Plate, St. Vincent, Lisbon, and home, 1883	3
Hay, —	S.S. Almora	2,613	E. S. Dawes, London	To and from Brisbane, viâ Suez, 1882–83	4
Hepworth, C. M. W., F.R. Met. Soc.	S.S. Danube	1,462	Union S.S. Co., Lim., Southampton	To and from Natal, &c., 1883	2
,, ,,	,,	,,	,, ,, ,,	To Algoa Bay, and trading between S. African Ports, 1883	7
Hird, William	Taranaki	1,130	J. Leslie, London	To and from Otago, 1882–83	6
Holdich, J. P., R.N.R.	British Envoy	1,265	J. Coupland, Leicester	To Melbourne, Newcastle (N.S.W.), San Francisco, and home, 1882–83	12

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage and Year.	Months of Register.
[14] Hoskyn, Lieut. and Comr. R. F., R.N.	Flying Fish - -	940	H.M.S. - - -	Surveying in China and Japan Seas, 1882–83 - - - -	4
[15] " "	" " - -	"	" - - - -	Surveying in China and Japan Seas, 1883 - - - -	1
" "	" " - -	"	" - - - -	Surveying in China and Japan Seas, 1883	4
" "	" " - -	"	" - - - -	At Hong-Kong, and surveying in Japan Sea, 1883 - - - -	4
Hughes, W. P. -	Laomene - -	1,746	D. Fernie, Liverpool - -	To Calcutta, New York, and home, 1882–83 - - - -	8
Jeffery, A. W., F.R. Met. Soc.	S.S. Ptolemy - -	1,401	Liverpool, Brazil, and River Plate S.N. Co., Lim., Liverpool.	From Antwerp to Rio Janeiro, &c., and home, 1883 - - -	2
" " -	" - -	"	" " "	To Rio Janeiro, New York, and home, 1883 - - - - -	2
" " -	S.S. Teniers - -	- - -	- - - - -	To Rio Janeiro, Maceio, New York, and home, 1883 - - -	3
[16] Jones, Edward, R.N.R.	S.S. Drummond Castle.	3,705	Sir T. Brassey, K.C.B., Westminster	To and from Cape Town, 1883 -	1
Jones, S. G.- -	Barque Hermine -	538	T. H. Jackson, Liverpool -	To and from Talcahuano, 1882–83 -	8
Kidley, W. H. -	S.S. Coptic - -	2,789	Oceanic Steam Navigation Co., Liverpool.	Trading between San Francisco and Hong-Kong, viâ Yokohama, and home from Hong-Kong, viâ Suez, 1882–84	10
Lailey, W. N. -	S.S. Derwent - -	986	Mercantile S. S. Co., Lim., London.	One voyage to and from Patras; one to Venice, Alexandria, and home, 1883–84 - - - - -	3
Lawson, James -	S.S. Humber - -	1,528	Royal Mail Steam Packet Co., London.	To Barbadoes and home, 1882–83 -	1
" " -	S.S. Minho - -	1,491	" " " -	To and from Brazil and River Plate, 1882 - - - - -	2

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage and Year.	Months of Register.
[17] Legg, William	Star of Greece	1,227	J. Corry, Croydon	To and from Calcutta, 1882–83	9
Lehman, Charles	Barque Mikado	643	W. Lund, Liverpool	To Swan River (W. A.) and Shanghai, and home from Iloilo, 1882–83	7
Lindguister, Aug.	S.S. Elysia	1,745	T. Henderson, Glasgow	To Bombay, New York (viâ Sucz), and home, 1883	3
Littler, W. T.	Barque Corinth	614	T. B. Walker, London	To and from Brisbane, 1882–83	7
[18] Lofley, —	Schooner Eira	—	- - - -	To Franz Josef Land, then by boat to Nova Zembla, 1881–82	13
Longley, H.	S.S. Mosser	1,323	J. H. Bushby, London	Two voyages to China and Japan, viâ Suez, back viâ Suez to New York, and home, 1882–83	9
McBride, A. C.	Barque Island Belle	313	J. McBryde, Stranraer	Hamburg to Monte Video, Buenos Ayres, Puntas Arenas, and Buenos Ayres, 1882	4
McDougall, A.	Auckland	1,245	The Albion Shipping Co., Lim., Glasgow.	To and from Otago, 1882–83	6
" "	"	"	" " "	" " 1883	6
McFee, J. B.	Barque Childers	896	R. J. Swyny, Liverpool	To Calcutta, New York, Melbourne, and home, 1881–83	17
Metcalfe, John	S.S. Oceanic	2,440	Oceanic Steam Navigation Co., Lim., Liverpool.	Trading between San Francisco, Yokohama, and Hong Kong, 1881–82	8
[19] Miller, A. T.	Conway	—	Training Ship	In the River Mersey, 1883	4
Milne, W. F.	S.S. Esquimaux	466	Dundee Whale and Seal Fishing Co., Dundee.	To Newfoundland, Davis Straits, and home, 1883	8
Moloney, E. J.	British Merchant	1,696	British Shipowners' Co., Lim., Liverpool.	To and from San Francisco, 1882–83	7
[20] Moore, Lieut. and Comr. W. U., R.N.	Dart	470	H.M.S.	To Simon's Bay, Adelaide, and Sydney, 1882–83	4
[20] " "	"	"	"	At Australian station, 1883	8
Mowatt, T. R., junr.	Barque Scottish Prince	895	A. McIlwraith, London	To Bundaberg (Queensland), Newcastle (N.S.W.), and Manila, 1881–82	5

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage and Year.	Months of Register.
Muir, John - -	Invercargill - -	1,246	Shaw, Savill, and Albion Co., Lim., London.	To and from Otago, 1882–83 - -	6
Murray, Alexander -	S.S. Windward -	321	W. Baxter, Peterhead - -	To and from Greenland, 1883 - -	4
[21] Murray, J. B. -	S.S. Ethiopia - -	2,604	Barrow Steam Ship Co., Lim., Barrow.	To and from New York, 1883 - -	28 days.
[12] ,, ,, -	S.S. Hispania - -	2,213	A. C. Henderson, Glasgow -	To and from Bombay, viâ Suez, 1883 -	2
Naird, James -	,, - -	,,	,, ,, -	,, ,, ,, 1883 -	2
[22] Nicholson, M. -	Simla - - -	2,172	T. L. Devitt, London ,, -	To Melbourne, Newcastle (N.S.W.), Bombay, and home, 1882–83 -	8
Niejahr, Wilhelm -	Barque Mersey -	963	W. Moodie, London - -	To Buenos Ayres, and home from Rosario, 1883 - - -	3
Norman, Francis -	Barque Polestar -	625	J. Lyne, Liverpool - -	To Valparaiso, 1882–83 - -	3
[23] Oldham, C. F., R.N., Lieut. in Command.	Lark - - -	—	H.M. Schooner - - -	From Auckland to Solomon Islands, Brisbane, &c., 1882–83 - -	4
[23] ,, ,, -	,, - - -	—	,, ,, - - -	At Australian station and New Zealand, 1882–83 - - - -	4
[23] ,, ,, -	,, - - -	—	,, ,, - - -	At Australian station, 1883 - -	4
[12] Pagan, James -	S.S. Tenasserim -	1,755	British and Burmese Steam Navigation Co., Lim., Glasgow.	To and from Rangoon, via Suez, 1883 -	3
,, ,, -	,, - -	,,	,, ,, ,, ,,	,, ,, ,, 1883–84	3
Parry, Moses, F. R. Met. Soc.	Barque Queen of Cambria	865	W. Thomas, Nevin, Carnarvonshire	To Port Chalmers, Valparaiso, and home, 1882–83 - - -	8
[24] Parsell, H. - -	S.S. Baltic - -	2,209	Oceanic Steam Navigation Co., Liverpool.	Four voyages to, and three from, New York, 1883 - - - -	3
[25] Parson, G. F. -	Earnock - -	1,198	W. Fraser, London - -	To Melbourne, Bombay, and home, 1882–83 - - - -	10
Patterson, J. E. C. -	Ellen Stuart - -	1,572	P. Douglas, Liverpool - -	To Calcutta, 1881 - - -	4
Pearson, C. W. -	S.S. Strathleven -	2,436	W. Burrell, Glasgow - -	To China and Japan, viâ Suez, thence to New York (viâ Suez), and Gibraltar, 1882–83 - - - -	5

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage and Year	Months of Register.
Pearson, David	S.S. Borghese	1,331	W. H. Raeburn, Glasgow	From Teneriffe to Buenos Ayres, St. Thomas, Charlestown, and home, 1883–84	8
Peebles, Robert	Barque Tweedsdale	1,403	J. Roxburgh, Glasgow	To and from Calcutta, 1882–83	8
" "	" "	"	" "	" " 1883–84	7
Penny, Hugh	Barque Madras	668	R. Kerr, Greenock	To Rio Janeiro, Anjer, and home, 1883	8
Perrin, Thomas	Ambrose	862	J. F. Gibb, London	To Adelaide, Newcastle (N.S.W.), Callao, Vancouver's Island, and home from Callao, 1882–83	10
Peters, J.	S.S. Gloucester	1,304	Great Western Steamship Co., Lim., Bristol.	Two voyages to and from New York, one to Malta, Palermo, Boston, Cape Breton, and home, 1882–83	4
Peterson, Walter	Barque Caldew	482	C. Wilson, Sunderland	To Mauritius, Singapore, and home, 1882–83	8
Plage, Robert	Barque Cottica	319	J. Grierson, Glasgow	To and from Surinam, 1883	3
Pomeroy, Herbert	Barque Elissa	409	H. F. Watt, Wavertree, Liverpool.	To Caravellas (Brazil), Cape Verdes, Bahia, Boston, and home, 1882–83	6
Price, J. H.	Barque Viola	595	C. T. Browning, Liverpool	To and from Valparaiso, 1883–84	6
Prout, J. C.	Cape St. Vincent	1,422	A. P. Lyle, Greenock	To Adelaide, Newcastle (N.S.W.), Java, and Cadiz, 1882–83	9
Quaile, D. W. A.	Orissa	1,199	R. Kerr, Greenock	To Calcutta, Mauritius, back to Calcutta, and home, 1882–84	11
Raeburn, John, R.N.R.	Lochee	1,728	D. Bruce, Dundee	To Sydney, Newcastle (N.S.W.), San Francisco, and home, 1883–84	9
Randall, W.	Dynomene	1,900	D. Fernie, Liverpool	To and from Calcutta, 1882–83	9
Renaut, C. H.	Pleione	1,092	The Shaw, Savill, and Albion Co., Lim., London.	To and from Wellington, New Zealand, 1882–83	7
Robinson, Thomas	Chinsura	1,266	T. Brocklebank, Liverpool	To Anjer, Akyab, and home, 1882–83	8
Rosseter, W. L.	Barque St. Kilda	865	A. T. Parker, Liverpool	To and from Demerara, 1883	3
" "	" "	"	" "	" " 1883–84	3

LIST OF DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage and Year.	Months of Register.
Russell, C. J. -	Candahar - -	1,418	R. Brocklebank, Liverpool -	To and from Calcutta, 1882–83 -	8
[26] Savage, Lieut. W. M., R.N.	L. H. Tender Richmond	183	Board of Trade, London - -	At the Bahamas, 1883 - - -	4
Scott, William -	Barque Commewyne -	315	J. Grierson, Glasgow - -	To and from Nickerie, 1883 - -	4
" " -	" " -	"	" " - -	To and from Surinam, 1883–84 -	8
Shaw, Gilbert -	S.S. Beta - -	1,087	W. Cunard, London - -	Four voyages between Halifax and Jamaica, viâ Bermuda, 1883 -	3
" " -	" - -	"	" " - -	" " " "	3
Shearer, George -	Barque Corona -	1,210	W. Stephen, Dundee - -	To Adelaide, Newcastle (N.S.W.), Colombo, Bombay, and home, 1882–83	10
Simpson, Alexander-	Schooner Traveller -	196	A. Simpson, Peterhead - -	To Ivigtut, Philadelphia, Ivigtut, Philadelphia, and Exmouth, 1883 - -	7
Sinclair, S. - -	Tamerlane - -	768	W. M. Dickie, London - -	From Sydney to Shanghai, Hiogo, Hong-Kong, Amoy, New York, and Glasgow, 1872–73 - - -	12
[9] Smith, J. H., R.N.R.	Worcester - -	—	Training Ship - - -	Off Greenhithe, 1883 - - -	4
Smith, W. C., F. R. Met. Soc.	Her Majesty - -	1,104	R. Grant, London - -	To Algoa Bay, Madras, and home, 1882–83 - - - -	9
[27] Smith, W. H., R.N.R.	S.S. Circassian -	2,356	R. G. Allan, Liverpool - -	One voyage to and from Baltimore; one to and from Portland; three to and from Quebec, 1883 - - -	4
Steven, David -	Barque Inch Keith -	1,238	A. Russell, Glasgow - -	To and from Calcutta, 1882–83 -	8
Stiven, J. H. -	Arethusa - -	1,272	J. Hamilton, Liverpool - -	To and from Adelaide, 1882–83 -	7
Strang, Robert -	Lyttelton - -	1,111	Shaw, Savill & Albion Co., Lim., London.	To and from Otago, 1883 - -	5
Tannock, R. S. -	Glencairn - -	1,564	A. Allen, Glasgow - -	To and from Rangoon, 1882–83 -	8
Thompson, Henry -	S.S. Basil - -	867	The Booth S.S. Co., Lim., Liverpool.	Two voyages from Havre to Lisbon, Brazil, and home, and one home from Brazil, 1882–83 - - -	4

LIST of DOCUMENTS, &c.—*continued.*

	Captain's Name.	Ship.	Tons.	Owners.	Voyage and Year.	Months of Register.
	Thompson, R. D.	Cosmo	1,220	J. G. Ross, Quebec	To Monte Video, Point de Galle, Calcutta, New York, and home, 1881–83	10
	Thorne, J. W.	Barque Falstaff	1,419	J. Beazley, Liverpool	To and from Calcutta, 1882–83	8
	Thorpe, J.	Thurland Castle	1,244	Lancaster Shipowners Co., Lim., Liverpool.	To Cape Town, Akyab, and home, 1882–83	8
	Tizard, Staff-Com. T. H., R.N.	Triton	410	H.M.S.	Surveying on east coast of United Kingdom, 1883	7
[28]	Tomlin, P. S.	S.S. Ballaarat	4,752	P. & O. Steam Navigation Co., London.	To Colombo, Melbourne, and back, viâ Suez, 1883	3
[29]	Travers, H. de la Cour.	S.S. Tartar	2,755	Union S.S. Co., Lim., Southampton	To and from East London, 1883	2
	Turner, E. W.	Barque Mertola	392	E. W. Turner, Garston, Liverpool	To and from River Guadiana, 1882	2
	" "	" "	"	" " "	Three voyages to and from River Guadiana, 1882	4
	Turpin, W. A.	S.S. Gaelic	2,652	Oceanic Steam Navigation Co., Liverpool.	One voyage between San Francisco and Hong Kong, viâ Yokohama; one from San Francisco to Yokohama, Hong-Kong, and home, viâ Suez, 1882–83	6
[7]	Vereker, The Hon. F. C. P., R.N.	Magpie	774	H.M.S.	From Hong-Kong to Manila, Labuan, and surveying on N.E. Borneo, 1883	4
[7]	" "	"	"	"	Surveying on N.E. Borneo, and to Singapore and Penang, 1883–84	4
[30]	Wait, A. McLean	S.S. Spartan	2,223	Union S.S. Co., Lim., Southampton	Two voyages to and from Algoa Bay, &c., 1883	4
[30]	" "	"	"	" " "	Two voyages to and from Cape Town, &c., 1883	4
	Walker, Henry	S.S. Cephalonia	3,490	Cunard S.S. Co., Lim., Liverpool	Four voyages to and from Boston; one to and from New York, 1883	4
	" "	S.S. Parthia	2,035	" " "	Three voyages to and from New York, one to and from Boston, 1883	4

List of Documents, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage and Year.	Months of Register.
[31] Watson, Alexander -	Barque Elvira -	464	H. F. Watt, Wavertree, Liverpool	To Natal, Calcutta, Demerara, Barbadoes, New Orleans, Hamburg, and home, 1882–83 - - -	10
[23] Wharton, W. J. L., R.N.	Sylvia - - -	1,050	H.M.S. - - - -	Surveying off Monte Video and in Straits of Magellan, 1882–83 -	4
[23] ,, ,, -	,, - - -	,,	,, - - - - -	Surveying in Straits of Magellan, and voyage to Monte Video, 1883 -	4
[32] ,, ,, -	,, - - -	,,	,, - - - -	On east coast of South America, 1883 -	4
[32] ,, ,, -	,, - - -	,,	,, - - - -	On east coast of South America, 1883–84	4
[33] Whiteside, J. -	Maggie E. Seed -	1,365	C. Whiting, Liverpool - -	To Monte Video, Valparaiso, Talcahuano, and home, 1882–83 - -	7
Wight, H. P. -	Oamaru - -	1,306	Albion Shipping Co., Lim., Glasgow.	To and from Otago, 1882–83 - -	6
[34] Williams, E. M. -	Barque Burdwan -	803	T. & R. Brocklebank, Liverpool -	To and from Batavia, 1882–83 - -	7
Wilson, John -	S.S. Ethiopia - -	2,604	Barrow S.S, Co., Lim., Barrow -	Two voyages to and from New York, 1883–84 - - -	2
Youlden, H. -	Barque May Hulse -	463	J. Ransom, Southampton -	To Buenos Ayres, Coronel, Talcahuano, and home, 1882–83 - - -	7
[35] Young, Thomas -	City of Agra - -	1,074	W. B. McGavin, London -	Christiania to Melbourne and home, 1882–83 - - - -	5

In cases distinguished by marginal numbers the Meteorological Registers were kept chiefly by Officers, as follows:—

[1] **Assisted by Messrs. Entwistle and Brooks.**
[2] **Kept by** H. Carew Reynell.
[3] **Kept by** Henry M. Lambert, 3rd Officer.
[4] **Kept by** G. Douglas Saunder, 3rd Officer.
[5] **Kept by** C. H. Kempson.
[6] **Kept by** Thomas Bannerman, 3rd Officer.
[7] **Kept by** Lieutenant Andrew Balfour, R.N.
[8] **Kept by** Richard Ladd, F.R.A.S., F.R. **Met. Soc.**
[9] **Kept by** George Denham.
[10] **Kept by** W. F. Tubbs, 4th Officer.
[11] **Kept by R. C. Kessler,** 4th Officer.
[12] **Assisted by Officers.**
[13] **Kept by T. Q. East, 2nd Officer.**
[14] **Kept by Lieutenants Henry Baker, R.N., and** George Pirie, R.N.
[15] Kept by Lieutenant Henry Baker, R.N.
[16] Kept by William B. Whall, Chief Officer, **assisted** by H. J. Nash, 2nd Officer.
[17] Assisted by W. Mackay, Chief Officer.
[18] Kept by W. H. Neale, M.B., and B. Leigh **Smith.**
[19] Kept by the Boys.
[20] Kept by Sub-Lieut. Robert P. Adams, R.N.
[21] Kept by Alex. Boyd, 2nd Officer.
[22] Assisted by C. H. Payne, 2nd Officer.
[23] Kept by Lieutenant Alec. Leeper, R.N.
[24] Kept by William P. Brownless, 3rd Officer.
[25] Assisted by 1st and 2nd Officers.
[26] Kept by Henry King Sturdee, Chief Officer.
[27] Kept by Messrs. Caine & Griffith, 3rd & 4th Officers.
[28] Kept by S. de B. Lockyer, 3rd Officer.
[29] Kept by George C. Gordon, 2nd Officer.
[30] Kept by J. W. Beresford Turner, 4th Officer.
[31] Assisted by T. G. Partington.
[32] Kept by Sub-Lieut. Wyndham Richardson, R.N.
[33] Kept by David R. Rees, 2nd Officer.
[34] Assisted by H. Cheriton, 3rd Mate.
[35] Assisted by H. Pike, 2nd Officer.

APPENDIX IV.

Instruments supplied, &c. to the Royal Navy.

Per Account.	Barometers.	Aneroids.	Thermometers.				Hydrometers.
			Ordinary.	Max.	Min.	Screens.	
April 1st, 1883, afloat	176	378	1,073	151	133	100	128
Issued since	58	76	265	24	25	14	34
	234	454	1,338	175	158	114	162
Returned since	61	88	270	33	31	14	43
April 1st, 1884, afloat	173	366	1,068	142	127	100	119

Instruments supplied, &c. for use at Naval Stations.

April 1st, 1883, in use	66	116	259	21	29	5	16
Issued since	13	2	61	6	5	1	—
	77	118	320	27	34	6	16
Returned since	3	4	70	8	8	1	—
April 1st, 1884, in use	74	114	250	19	26	5	16

Disposition of Admiralty Instruments on April 1st, 1884.

Afloat in Royal Navy	173	366	1,068	142	127	100	119
In use at stations	74	114	250	19	26	5	16
In store at M.O.	115	106	130	48	69	16	74
„ Chatham	4	6	16	4	3	4	4
„ Sheerness	4	8	13	3	3	3	15
„ Portsmouth	3	5	19	5	3	8	23
„ Devonport	2	8	13	5	5	7	28
„ Queenstown	3	3	1	1	1	—	8
„ Gibraltar	1	4	2	—	—	—	4
„ Malta	13	10	38	5	3	4	22
„ Halifax	2	8	5	2	5	—	12
„ Bermuda	3	6	43	—	2	—	15
„ Jamaica	1	—	1	—	—		—
„ Cape of Good Hope	7	2	5	6	6	—	31
„ Trincomalee	2	4	27	4	4	—	—
„ Hong Kong	3	6	21	4	5	2	10
„ Coquimbo	—	7	8	1	2	—	23
„ Sydney	2	5	56	1	2	—	—
„ Esquimalt	6	6	10	3	3	—	—
Total, April 1st, 1884	418	674	1,726	253	269	149	404
Lost, &c. since April 1st, 1883.	—	3	196	14	11	5	17
Under repair	3	—	—	—	—	—	—

APPENDIX V.

INSTRUMENTS supplied, &c. to Mercantile Marine.

Per Account.	Barometers.	Compasses.	Thermometers.				Hydrometers.
			Ordinary.	Max.	Min.	Screens.	
April 1st, 1883, afloat	140	—	764	—	—	145	493
Issued since	123	—	704	—	—	117	391
	263	—	1,468	—	—	262	884
Returned since	115	—	678	—	—	107	398
April 1st, 1884, afloat	148	—	790	—	—	155	486

INSTRUMENTS at Stations, viz., Telegraph Offices, Observatories, Navigation Schools, &c.

April 1st, 1883, in use	104	3	248	62	64	39	41
Issued since	17	1	24	4	3	2	4
	121	4	272	66	67	41	45
Returned since	10	—	21	4	8	6	4
April 1st, 1884, in use	111	4	251	62	59	35	41

DISPOSITION of Board of Trade Instruments on April 1st, 1884.

In merchant ships	148	—	790	—	—	155	486
In use at stations	111	4	251	62	59	35	41
In store at M.O.	36	1	200	1	40	40	96
At Liverpool Agency	9	8	35	—	—	8	29
„ Aberdeen „	2	—	15	—	—	1	30
„ Glasgow „	8	—	47	—	—	8	31
„ Dundee „	4	—	38	—	—	10	25
„ Hull „	5	—	33	—	—	8	19
„ Southampton „	4	—	19	—	—	6	18
„ Cardiff „	1	—	8	—	—	2	5
Total, April 1st, 1884	328	13	1,436	63	99	273	780
Lost, &c. since April 1st, 1883	7	—	200	—	8	24	81

APPENDIX VI.

LIST of STATIONS reporting Meteorological Observations by Telegraph to the Office on 31st March 1884, with the Names of Observers.

*†Sumburgh Head	Rev. W. Brand	Minister of Dunrossness.
*†Stornoway	D. MacDonald	Late Officer S.S. "Great Eastern."
Wick	J. Sinclair	Watchmaker.
Nairn	W. D. Penny	Schoolmaster.
*†Aberdeen	J. McCormack	Telegraph Clerk.
Leith	W. Hay	Do.
*†Shields	J. W. Irvine	Do.
Spurn Head	J. B. Smith	Assistant Lightkeeper.
†York	H. M. Platnauer	Curator of Museum.
Loughboro'	W. Berridge, F.R. Met. Soc.	
†Ardrossan	J. W. Mayes	Telegraph Clerk.
*†Mullaghmore	K. Kerr	Coastguard Officer.
Donaghadee	T. MacGowan	Telegraph Clerk.
Parsonstown	G. Phillips	Assistant Observer at Lord Rosse's Observatory.
Barrow-in-Furness	W. S. Whitworth	Engineer, Barrow-in-Furness Railway.
*†Holyhead	Griffith Jones	Keeper of Sailors' Home.
Liverpool	J. Hartnup, junr.	Bidston Observatory.
*†Valencia	J. E. Cullum	Superintendent of the Observatory.
Roche's Point	W. Kennedy	Telegraph Clerk.
Pembroke	Messrs. Blake and Baker	Lightkeepers.
*†Scilly	W. Thomas	Signalman.
Prawle Point	J. John	Coastguard Officer.
†Hurst Castle	G. G. Appleton	Lightkeeper.
†Jersey	J. Fisher	Signalman.
*†Dover	J. Costello	Telegraph Clerk.
*†London	F. Gaster, F.R. Met. Soc.	Clerk, Meteorological Office.
Oxford	W. Wickham	Radcliffe Observatory.
Cambridge	H. Todd	Observatory.
*†Yarmouth	G. T. Watson	Secretary, Sailors' Home.
†Hawes Junction	W. Foster	Station Master.

Note.—Those stations marked with an asterisk (*) report also at 2h. p.m.; and those with a dagger (†) at 6h. p.m.

The Council are making arrangements to establish stations at Belmullet, Co. Mayo; Malin Head, Co. Donegal; and Dungeness, Kent.

APPENDIX VII.

REPORTS ON THE INSPECTION OF THE STATIONS IN 1883.

A.—Report of Inspection of the Irish and Welsh Stations with Scilly.

Telegraphic Reporting Stations.

Holyhead.—The new observer, Mr. Griffith Jones, is very attentive, but is unfortunately not a seaman, and has not been much accustomed to outdoor work, so that he had not had experience in judging of weather prior to his appointment. The station was in a satisfactory condition. The anemometers are both in good order.

St. Ann's Head.—This station calls for no particular remark. The exposure of sunshine recorder, thermometer, and rain gauge is the best at any of our stations.

Donaghadee.—The observer continues to be very satisfactory, but the exposure of thermometers and rain-gauge is not very good, being in a rather confined garden, and, in particular, there is no site available for a satisfactory wind vane.

Mullaghmore.—The station is in very good order, and since the establishment of telephonic communication it has been one of our most useful points of observation. Mr. Kerr, the reporter, is, I regret to say, to be superannuated at about the end of next year. It will be very desirable, if possible, to retain him at Mullaghmore. It is not likely that his successor, as chief officer of the coastguard, will take as much interest in the work as Mr. Kerr has done.

Belmullet.—In accordance with your instructions, I visited Belmullet. The town lies about 80 miles to the westward of Mullaghmore. It is situated on the isthmus connecting the Mullet peninsula with the mainland. Blacksod Bay, to the south, is about 15 miles long, Broadhaven, to the north, about eight, so that no direct reports of sea disturbance are procurable at Belmullet. The nearest point from which the open sea can be observed, though at a distance of a mile, is the church at Binghamstown, distant about 250 yards from the village. But that village consists of some 20 cottages, and no competent observer resides there at present. It is distant about two miles from Belmullet, and a private wire would be requisite to cover that distance.

At Belmullet itself the wind exposure is very satisfactory. There is no higher elevation than 100 feet for a long distance except the hills about Ballyglass and Erris Head, which reach 400 feet and are distant, say, four miles to the northward. The whole central part of Erris, the western barony of Mayo, is a level bog, with little elevation except along the north coast, so that the winds would be certainly true.

I learn from gentlemen resident at Belmullet that a competent observer could probably be found. I think the station would be a useful one, but its adoption would involve the maintenance of Mullaghmore, inasmuch as that would supply reports of sea disturbances from a well-exposed headland.

I may say that the telegraphic wires will probably be laid to Belmullet before Christmas.

Parsonstown.—This station calls for no special remark, except that the actual observers for the telegraphic reports and the second order observations, respectively, are clerks in an office in the town, and cannot therefore keep such a constant watch on the clouds and weather generally as is desirable and is obtainable at coast stations.

The deficiency is to some extent supplied by the occasional observations of Dr. Bœddicker, the astronomical assistant to Lord Rosse. The instruments are in good order. The wind reports continue to be unsatisfactory, as the grounds are densely wooded and the timber fine.

Roche's Point.—This station continues to be satisfactory.

Valencia.—The station calls for no remark; the substitution of telephones for the A B C instrument on the private wire has been a great improvement, and as the telegraphic clerk at the post office has been changed, the cause of complaint as to delay in the messages has been removed.

I have examined the country between the observatory and the top of Jokaun Hill, the proposed site for an automatic electric anemometer, and I fear that the cost of erection and maintenance of a wire for about four miles in such an exposed position would be very great.

Foynes.—This is a station furnishing information for the Weekly Weather Reports. It is not very satisfactory, as the observer has not as yet found any assistant or substitute when he is unavoidably absent.

STATIONS OF THE SECOND ORDER.

Dublin (*Mountjoy*).—This station continues very satisfactory. The observers are both very intelligent, and the instruments in good order. The only change in prospect at the station is that a new scaffolding for the anemometer and sunshine recorder is being erected, the old one referred to in my report for 1878 being decayed.

Dublin (*Fitzwilliam Square*). — This station fully maintains its character as being as good as is possible for a town situation.

Dublin (*Glasnevin*).—This station is in very good order. On the whole it may be said that Dublin is as well represented climatologically as any city in the United Kingdom.

Colebrooke.—This station continues in the same condition as heretofore.

Markree.—I expect that this station will show a marked improvement in future. Mr. Marth, the present observer for Colonel Cooper, took up the work in May.

OBSERVATORIES.

Armagh.—The instruments were in good order.

Valencia.—I found this observatory in a very satisfactory condition, The anemograph, however, now requires renewal, at least in the most important parts. Mr. Whipple recommended such renewal last year. The fans and cups are much worn, and the wheel work has much backlash.

If the Council think of improving the observatory, it might be advisable to lower the thermograph bulbs. This could be done at comparatively little cost by completing the fourth side of, and roofing in, the space between the present thermograph screen and the ground.

(Signed) ROBERT H. SCOTT.

Meteorological Office, October 13, 1883.

B.—REPORT ON THE INSPECTION OF THE ENGLISH STATIONS.

TELEGRAPHIC REPORTING STATIONS.

London (*Brixton*).—I found everything in excellent order. Continuous barometric comparisons having been carried on between the instrument at this station and those at the Meteorological Office, it did not appear necessary to make any on this occasion.

Jersey (*Noirmont*).—I took with me to this station the "uncontracted" Adie's barometer 531, to be substituted for the check barometer

416. It was in good order, but read ·008 higher than the reporting barometer (the Kew corrections being applied). I found the instruments at this station in admirable order, and the observer is most painstaking. He estimated the wind force as 4 on the 26th, when my estimate was 5.

Hurst Castle.—The instruments at this station were in good order. The observer seems fairly careful, but makes occasional mistakes.

Prawle Point.—The observations at this station are most carefully taken, and the instruments are in excellent order. The instruments read well together. The observer, Mr. J. Johns, will quickly learn cloud observing, and I think that cirrus reports from this station would have considerable value.

Scilly (*St. Mary's*).—Wooden stays have been attached to the anemometer turret, which now vibrates but little in a storm. A portion of the iron of the case has been filed away, so that the pendulum does not touch the side. The clock required cleaning, parts of the works being somewhat rusted. The anemograms are not very distinct, the fault being due not to the instrument, but to the effects of salt and damp upon the paper. The observer's estimate of wind force is in better accord than formerly with the anemograms, but is now a trifle lower than the average estimate of the English observers. Both the reporting and check barometers were in absolute accordance with the standard 590.

York.—The observations at this station show slight improvement as regards the accuracy of the observer's readings. The reporting barometer (No. 156), which, when last compared, appeared to have a minus error, read on this occasion as much as ·045 above my standard. The instruments had been suspended together for four hours, but at the time of the comparison the mercury was oscillating considerably. A good vane is wanted here, and in its absence the observer's estimate of the direction of the wind is not always accurate, *e.g.*, on the day of my visit, trusting to the Minster vane, the observer noted the wind as South, when it was S.S.E. The minimum thermometer (M.O. 64) reads somewhat low.

Spurn Head.—Since my last visit the barometer, formerly employed as a check instrument, has been adopted as the reporting barometer. (The instruments, however, not having been shifted.) Though reading higher than the instrument previously employed, it gave low readings as compared with my standard. The outdoor instruments are in excellent condition. I gave orders that the screen should be moved so as to face due North, which has since been done. The thermometers read very well together, and agreed with the standard. The observer appears very accurate in his estimate of wind and sea disturbance. The latter is estimated by the motion of the lightship outside, whenever this is visible, the tide producing peculiar seas upon the point itself.

North Shields.—As was the case in 1882, the wet-bulb thermometer of this station was found in a very foul condition. The other instruments were in good order, excepting the spare thermometer. The old rain gauge continues in good order.

Second Order Stations and those furnishing Weekly Weather Reports.

Hastings, St. Leonards.—All the instruments were found to be in particularly good order, and the observations are well kept up.

Southampton.—The work at this station appears to be admirably conducted. The observer happened to be absent on leave on the occasion of my visit. I found that his assistant read the instru-

ments and made the reductions correctly. The undesirable alterations in the site of the outdoor instruments mentioned in my report of 1882 would in any case have become necessary now, as the ground on the north side of the Ordnance Survey Offices is now fully occupied by new computing rooms. The returns from the station are excellent, and it may be mentioned that the observer distinguishes cloud forms with unusually facility.

Jersey, St Aubin's.—I did not dismount the instruments, as the observer expressed a wish that this should not be done, if avoidable. They are all unchanged and have been frequently and satisfactorily tested. Everything was in good order at the station, and the returns continued to be very complete.

Totnes.—Everything at this station was found in good order. Since my last visit the screen had been, for the convenience of the observer, shifted 13 yards S.E. by S. of its former position, a change which can produce no effects on the readings. The situation of the station appears to me to be such as to favour rather high maxima of temperature for this part of England.

Helston.—All the instruments at this station were found to be very good and in excellent order. The barometer has never been verified at Kew, but its readings underwent more than 60 comparisons at Falmouth Observatory in September 1882. The two comparisons made by me were in agreement with those determined at Falmouth. The observer at this new station, Mr. J. Gill, appears to be painstaking and accurate.

Leicester.—The instruments were found to be in tolerably good order. The observer's reading of the barometer was as much as ·02 below my reading of the same instrument, the error being due to misadjustment of the fiducial point. The curator of the museum expressed his readiness to have the instrument shifted at a future time to a position where the light will be somewhat less inconvenient.

Peel (Isle of Man).—The altitude of the ground above sea level, as determined by barometric comparisons, is 137 ft. The country around is hilly, but the station has a very fair exposure, with a good view seaward (West). In the earlier returns from this station there were a few errors, but at the time of my visit the observer, Mr. T. H. Davis, read the instruments with the greatest rapidity and accuracy. He has a resident assistant who is quite competent for the work. All the instruments were found to be in excellent order, excepting the rain gauge, which had received an injury to the rim, and was about to be replaced by another instrument. There are also self-recording vanes and rain gauges of the observer's own design.

Douglas (Isle of Man).—The instruments at this station were found, as on previous occasions, in excellent order. The former assistant having left, and the present assistant being not quite competent for hygrometric reductions in Mr. Moore's frequent absence, the reductions have been somewhat interrupted. The observer set the vernier of the barometer much too low, an error shared to some extent by the assistant. Instructions were given on this point.

York.—The observer has, I think, made some further progress since the date of the former inspection, but the observations are still somewhat rough, and those on the direction of the wind do not appear to be always trustworthy. There have been some interruptions in the sunshine records, which it may be hoped will not again occur.

Alnwick (Northumberland).—Major Holland, who conducts the observations for the Duke of Northumberland, was absent on the day of my visit, but I obtained permission from his Grace to examine

the instruments. I was unable to dismount the thermometers. They are good instruments and read correctly, as compared with my standard in air. They have a good window-exposure facing North, but their height above the level of the ground (21 ft. 9 in.) is objectionable. A correction for altitude is made in the reports. Their altitude above the sea level is 202 ft. 10 in. The barometer is a good Fortin. The anemometer has a good position, but the connexions are long and complex. The rain gauge which is fairly exposed, is 178 feet above mean sea level.

Hesley Hall (*near Bawtry*).—The observations are usually taken by Mr. Whitaker's gardener, who is a competent observer. The instruments were in good order. The Stevenson's screen has not a very perfect exposure, and is not over grass. The rain gauge is also considerably sheltered by a fruit tree on the North side. Mr. Whitaker promised to consider the question of removing the outdoor instruments to a site upon the lawn, where their exposure will be very good.

Where several comparisons have been made, the mean result has been recorded. The asterisk indicates that the Kew correction has been applied to the observer's instrument, previously to comparison; its absence that it has not been applied.

TELEGRAPHIC REPORTING STATIONS.

STATION.	Barometers.			Thermometers.				
	Difference of Observer's from Inspector's Readings.	Reporting.	Check.	Temp. of Water.	Dry Bulb.	Wet Bulb.	Max.	Min.
				°	°	°	°	°
Hurst Castle	−·001	−·016	−·019	63	0·0	0·0	0·0	−0·7
Jersey	−·001	−·006	+·006	60	0·0	+0·2	+0·1	0·0
London	—	—	—	58	0·0	−0·1	−0·2	−0·1
Prawle Point	−·002	−·004	−·006	62	−0·1	0·0	+0·1	−0·3
Scilly	−·001	·000*	·000*	61	0·0	0·0	+0·1	+0·2
Shields	−·001	−·003	−·005	53	0·0	+0·1	0·0	−0·4
Spurn Head	0·0	−·010	−·015	53	−0·1	+0·1	+0·1	−0·4
York	0·0	+·045	—	53	−0·1	+0·1	+0·2	−0·6

STATIONS furnishing MONTHLY and WEEKLY REPORTS.

STATION.	Barometers.		Thermometers.				
	Difference of Observer's from Inspector's Readings.	Error of Barometer as compared with Inspector's Standard.	Dry Bulb.	Wet Bulb.	Maximum.	Minimum.	Grass Minimum.
	°	°	°	°	°	°	°
Alnwick	−·001	—	—	—	+0·1	+0·1	—
Bawtry	+·001	−·004	—	—	0·0	−0·1	—
Douglas	−·008	−·002*	0·0*	0·0*	0·0*	−0·1*	—
Hastings	0·0	−·004*	0·0*	−0·1*	−0·1*	−0·1*	—
Helston	+·004	−·001	−0·1*	−0·1*	−0·6*	−0·9*	—
Jersey	0·0	—	—	—	—	—	—
Leicester	−·020	—	0·0	+0·2	0·0	−0·5	−0·6
Peel	−·001	−·004*	0·0*	−0·3*	+0·1*	−0·3*	−2·1*
Southampton	+·001	−·006	−0·1*	−0·1*	−0·1*	0·0*	−0·2*
Totnes	−·001	—	−0·1*	0·0*	0·0*	0·0*	—
York	0·0	+·045	−0·2	0·0	−0·5	−0·5	—

(Signed) W. CLEMENT LEY.

Report of Inspection of the Scottish Stations.

C.—Barometers.

The barometers at all the stations were compared with inspector's mercurial standard barometer No. 588, and the thermometers with inspector's standard No. 2,522. The small aneriod No. 11 was also read at each inspection, but as its readings are very irregular, it is not intended to include them in this report.

The following table gives the corrected readings of standard No. 588, and the uncorrected readings of the reporting and check barometers at each of the stations, from which it appears that all of these instruments continue to be in excellent order:—

Stations.	Inspector's Standard No. 588. Corrected.	Reporting Barometer. Uncorrected.	Check Barometer. Uncorrected.	Remarks.
Dundee	29·089	29·090	—	
Aberdeen	28·614	29·610	—	In post office.
Do.	28·879	—	28·880	In house.
Braemar	28·191	28·190	—	
Nairn	29·331	29·331	29·327	
Inverness	29·529	29·529	—	Red. same temp.
Dunrobin	30·007	30·009	—	
Wick	29·713	—	29·713	In house.
Do.	29·773	29·772	—	In shop.
Dunrossness	29·962	29·963	29·960	
Sandwick	30·080	30·093	—	
Stornoway	29·983	29·984	29·982	
Laudale	29·543	29·557	29·551	Red. to same temp.* Check barometer is 8 feet higher.
Rothesay	29·667	29·670	—	
Ardrossan	30·068	30·067	Under repair.	
Leith	30·002	29·993	—	In house.
Do.	29·983	—	29·978	Red. to same temp.
Pinmore	29·371	29·372	—	This is observer's second reading.
Observatories.				
Aberdeen	29·663	29·665		
Glasgow	29·465	29·472		

* In these two instances, the difference between the attached thermometer of the Inspector's and of the station barometer has been allowed for.

Excepting at two stations referred to below, the difference between the observer's and inspector's readings in no case exceeded 0·002 inch. In setting the vernier and reading off, I use a magnifying glass, but the observation is made by each observer in his usual way. The observer at Leith set the vernier 0·004 too low. On a second reading being taken he did it correctly.

Thermometers.

The following table gives the results of comparisons made with inspector's standard No. 2,522, and the thermometers at the different stations and observatories, the readings of the standard being corrected

for instrumental errors, none of the Kew corrections for the station thermometers, however, being allowed for :—

Stations.	Standard No. 2,590, Corrected.	Dry Bulb.	Wet Bulb.	Spare T.	Max.	Min.	Time in Water in Minutes.	Change of Temp.	Notes.
	°	°	°	°	°	°		°	
Dundee -	59·2	+0·5	+0·6	—	+1·3	−0·2	90	Uniform	
Aberdeen -	56·5	+0·4	+0·5	+0·4	+0·5	+0·1	80	−0·2	
Braemar -	51·6	+0·5	+0·5	—	+0·5	−0·2	80	+0·1	
Nairn -	56·0	+0·2	+0·7	+0·7	0·0	+1·0	75	+0·1	
Inverness -	57·1	0·0	+0·1	—	−0·1	+0·1	40	Uniform	Min. on grass −0°·3.
Dunrobin -	62·0	−0·4	−0·5	—	+0·5	−0·7	90	+0·2	
Wick - -	59·8	+0·4	+0·4	—	0·0	+0·1	60	Uniform	
Dunrossness	57·1	+0·3	+0·4	+0·2	+0·4	−0·5	140	+0·1	
Sandwick -	58·0	+0·3	−0·1	—	+0·5	−0·5	180	+0·2	Max.Sun+0°·2.
Stornoway -	57·7	+0 7	+0·6	+0·5	−0·3	−0·4	70	+0·3	Min on grass 0°·0.
Laudale -	61·9	+0·2	+0·1	—	+0·2	+0·2	120	Uniform	
Rothesay -	57·5	−0·1	0·0	—	0 0	−0·2	75	−0·2	
Ardrossan -	58·5	+0·4	+0·4	—	0·0	−0·4	70	+0·3	
Leith - -	49·3	+0·2	+0·5	—	+0·1	−0·2	40	+0·4	
Pinmore -	46·7	+0·2	+0·3	—	−0·3	−0·1	80	−0·2	
Observatories.									
Aberdeen -	58·7	−0·1	+0·5	—	+0·5	0 0	70	Uniform	
					No. 10579	No.5433			
Glasgow -	54·6	+0·2	0·0	—	0·0	−0·1	110	Uniform	Min. No. 1,222 −0°·2. Min. on grass −0°·9.

Since last report a new minimum thermometer has been supplied to Laudale, and a new maximum to Leith. The thermometers at Stornoway are to be removed to a better position; and arrangements have been definitely made for clearing off a considerable part of the wood close to the station at Nairn, by which the whole of the observations will be improved.

Hygrometers.

The observations of the dry and wet bulbs are so well made generally as to call for no special remark.

Rain Gauges.

It will be seen from the "squeeze" sent in October, that the rain gauge at Leith was at the date of inspection considerably off the circular. It was then made circular.

At Aberdeen Observatory the pencil tracings examined were clear and distinct, and an examination showed that the pencil worked without any undue friction. The pencil tracings of the rain gauge at Glasgow Observatory were also carefully examined, particularly the first part of the tracing after each emptying of the gauge. The tracing from 7 to 8 p.m. of August 13th is very curious, and not easy to account for.

Anemometers.

The little wooden hut for the anemometer at Sandwick was thoroughly repaired and re-painted in spring. As regards the anemograph sheets, when the pin is pressed down at 10.30 a.m. it marks

10.15 a.m. on the sheet, there being thus a constant error of 15 minutes on the sheets, and this error has probably continued since last time the instrument was repaired. The irregularity in the velocity curve at Aberdeen noticed in last report was, in all cases I had an opportunity of examining, much reduced. At Braemar the anemometer is on a pole 18 feet high, which was a suitable position at the time it was first placed there, but as some trees have grown up round the plot of grass of the observatory, interfering somewhat with the readings, it is proposed to raise it a little higher.

NOTES on the STATIONS.

Aberdeen.—Stevenson's screen was ordered to be re-painted. Everything else at this station was found to be in very good order.

Nairn.—All the instruments were in good order, were correctly read and reduced by Miss Penny, who was in charge of the station at the time of inspection, Mr. Penny having been called away owing to the death of his brother. I am glad to report that definite arrangements have at last been made for clearing away a considerable portion of the wood close to this station, by which the observations will be much improved.

Wick.—Everything at this station was in good order, and no change was required.

Dunrossness.—At the time of inspection the Rev. W. Brand was on his annual ministerial visit to Fair Island, but Mrs. Brand made and reduced all the observations, prepared the daily report, and despatched it to London in a very satisfactory manner. Attention was directed to the careful recording of all changes of weather occurring between two telegraphic messages to the Meteorological Office; and in future care is to be given that these changes are to be incorporated into the first message sent thereafter to London.

Stornoway.—The observations are carefully and correctly made by Mr. McDonald and his daughter. By some mistake, the rain gauge and Stevenson's screen remained in the positions they occupied at last inspection. Mr. McDonald was directed to remove them to the position indicated in my report of last year, and to intimate the date of change to the Office. The instruments are well attended to.

Ardrossan.—During the recent repairs in the Post Office, the reporting barometer was broken, and since then the check barometer has been used instead. This instrument, as the comparison with the standard showed, had been safely conveyed from Saltcoats to its position at Ardrossan.

As requested, special inquiry was made regarding the wind observations made at this station. From a long conversation with Mr. Mayes it seemed to me that these observations are made by him with fair intelligence. He stated as a fact that considerably more damage was done to the slates and chimney-pots at Saltcoats than at Ardrossan, but did not think the gusts of wind were stronger at the latter place. It is, however, possible that at Ardrossan those gusts may be less strong which accompany the winds blowing straight upon the abrupt rising ground or cliff immediately to eastward of the village. This point I shall give some attention to next inspection.

Leith.—The observer read the barometer 0·004 inch too low, and all his readings hitherto have probably been too low to that amount. After being shown the proper way of setting the vernier, he took several readings and all of them were correctly made. The old maximum thermometer, which was not working quite satisfactorily,

was replaced by a new one from the Office in July last. The check barometer, which had been removed to its present position on the death of Mr. Hutchison, was compared and found in good order. Shortly after last inspection, the Stevenson's screen was thoroughly repaired, painted, and firmly fixed, and the rain gauge was also repaired and well fixed.

Dundee.—The observations are made within the grounds of the Dundee Cemeteries. The situation is open on a long ridge lying east and west, and sloping southwards to the Firth of Tay. The thermometer screen is of the pattern supplied to the stations of the Scottish Meteorological Society before Stevenson's came into use, which it closely resembles. The instruments were all in good order and carefully observed. The maximum thermometer was broken in the end of 1879 and replaced by the present one, it being omitted at the time to report the fact to the Office. From the date of inspection, the thermometric observations, which had previously been read only to whole degrees, were begun to be read to tenths of a degree. The rain gauge is placed in an open space in the grounds at some distance from the other instruments.

Braemar.—This station is in a small open grass field near the centre of the village which slopes slightly to westward. The instruments belong to the Queen. They are all in excellent order and are read with care and intelligence by Mr. Aitken. The barometer and thermometers in shade are placed in a large wooden screen designed by the late Prince Consort and Sir James Clark in 1855, in the form of an octagon, 8 feet in diameter, and louvred all round. A Stevenson's screen will be added to the observing instruments with the view of ascertaining what temperatures are obtained by the screen so long in use and the screen now in general use among meteorologists. There is a snow gauge at this station about 18 inches in diameter and 2 feet in height. There is a vane and an anemometer on a stout pole with ladder, 18 feet high, its position at the time of erection was very good, but some trees have since grown up in the vicinity which possibly may somewhat shelter the cups. For so hilly a situation the exposure is remarkably good. The degree to which the winds are diverted from their course will appear from the following 15 years' averages:—N. 16, N.E. 41, E. 22, S.E. 24, S. 41, S.W. 163, W. 26, N.W. 28, and calms two days. The above mean of 163 days of S.W. winds is greatly above the general average of Scotland.

Inverness.—In February 1883, the temperature observations ceased to be made, the thermometers being found to be too far from the observer. At the same time the rain gauge was removed to the present position, which is so unsuitable that the rain observations are worthless. Mr. Fraser removes to another house in May, where, he informed me, suitable arrangements can be made for all the instruments. In the meantime, the barometric wind and weather observations continue to be made.

Dunrobin.—The instruments are placed in good positions on a large grass plot forming part of a long narrow strip of ground lying between Dunrobin Castle and the sea. The hilly ground, which rises immediately to westward, must occasion deviations in the direction and force of the wind. The mean direction on an average of 12 years is N. 38,N.E. 34, E. 72, S.E. 27, S. 18, S.W. 46, W. 92, and N.W. 38 days, thus showing an undue local predominance of west and east winds. The thermometer box is one of the sort in use when the station was established in 1859, and may be regarded as fairly comparable with Stevenson's

screen. A Stevenson's screen is to be added as soon as possible. The instruments were in good order, and the observations carefully and correctly made.

Sandwick.—The anemometer hut was repaired in spring in a thoroughly satisfactorily and substantial manner. The sunshine recorder is placed on a stout square wooden pillar, box-shaped on the top. On examination, the slate pedestal of the instrument had been inadvertently placed out of its proper position when removed in spring from its former place, thus confirming the opinion formed in the Office that its orientation was not properly attended to. It was put right. Greenwich mean time is observed in making all the observations, and every opportunity of bringing correct time from Stromness and Kirkwall is taken advantage of.

All the other instruments were in good order and the observations, as heretofore, continue to be made with correctness and fidelity.

Laudale.—A new minimum thermometer replaced the old one on January 4th. As the Stevenson's screen is now stayed with stout wire (No. 10), double and twisted, the thermometers may be regarded as secured against the violent winds which occasionally occur at this station. The instruments were all in good order.

Rothesay.—The station is at Barone Cottage on the rising ground about three-quarters of a mile to the west of Rothesay. The ground there slopes gently to the south. Barone Hill, 530 feet high and 1½ miles distant, is the highest point of a ridge lying approximately from S.W. to N.N.E. of the station. The position is open and the winds observed are only subject to such deflection as may be occasioned by this ridge.

A portion of spirit equal to about a degree was found at the top of the tube of the minimum thermometer. Mr. Kay, under direction, put it right. The rain gauge was not quite circular; the circularity was restored. All the other instruments were in good order and the observations made with care and accuracy.

Pinmore.—The station is situated close to the Stinchar in a rather deep valley surrounded by heights and hills. The piece of level ground in the curve of the river near the garden extends to about 10 acres. It is probable that the winds are a good deal deflected owing to the configuration of the land.

The thermometer screen is of the pattern in use before Stevenson's, and closely resembles that screen. It is placed at the edge of a large grass plot, with the black soil of a rose and flower plot on the other side, which is to be turfed for some distance round the screen.

The height of the barometer has been hitherto entered at 187 feet instead of 190 feet, which is the correct height of the cistern. It was known that Mr. Donald set the vernier to the level of the clear surface of the mercury in contact with the glass tube, for which error of observation a provisional correction of +0·035 inch had been adopted. The inspection confirmed the above. The vernier is now set, and the instrument read correctly. As regards the other instruments they were well placed, in good order, and well observed.

Aberdeen Observatory.—The rain gauge is still, as shown by the squeeze, off the circular, but no attempt was made to alter it owing to its construction. The pencil tracings of the rain gauges, which there was an opportunity of examining, were clear and distinct, and showed that the pencil was working without undue friction. All the instruments were in very good order and well attended to.

Glasgow Observatory.—The pencil tracings of the rain gauge were carefully examined, particularly the first part of the tracing after each

emptying of the gauge. The examination showed an improved distinctness in the tracings. Every thing at the observatory was in good order.

(Signed) ALEXANDER BUCHAN.

D.—REPORT ON THE INSTRUMENTS AT THE OBSERVATORIES.

In conformity with your instructions, I beg leave to report to the Meteorological Council that I inspected the self-recording observatories at Aberdeen and Valencia, and at the same time (at the request of the Rev. S. J. Perry) I also visited the Stonyhurst Observatory.

Stonyhurst.—The whole of the instruments here were in excellent order, and neither the clocks nor the lenses required cleaning. My attention, however, having been specially called to the backleash existing in the anemograph, I carefully examined the instrument in this respect, and am of opinion that the defect cannot be obviated in its present form.

The clutches connecting the shafting to the pencils were noticed to be somewhat loose in their fittings, and Mr. Carlisle thought if these were tinned over so as to make them fit a little tighter, it might have a tendency, at all events, to improve the direction trace, so that when a sudden shift in the vane takes place the pencil would mark at once instead of lagging behind or skipping.

With this I agreed, and Mr. Carlisle promised to get it done.

The velocity shaft was dismounted, and the cup-bearing oiled, after which the orientation was carefully tested.

My attention was next called to the extremely dirty condition of the cistern of the large standard barometer used for the control observations. I therefore decided to dismount it, but experienced considerable difficulty in so doing, as the screws had become rusted, the instrument never having been detached from its frame since its erection in 1868.

The cistern was cleaned and the contained mercury filtered, after which the barometer was replaced and levelled. A comparison of the standard thermometers was made with Kew standard No. 571, and found to give the following corrections at 60° :—

Dry bulb, No. 619, −0·15. Wet bulb, No. 382, −0·35.

The rain gauge was in good order, and "squeezes" of the self-recording as well as the spare gauge funnels were taken.

Aberdeen.—At this observatory all the instruments were in good order.

I deemed it advisable, however, to clean the barograph and thermograph clocks, as well as the lenses and other parts generally.

The exterior portion of the anemometer was dismounted, thoroughly overhauled and cleaned, but the clock and recording apparatus only required oiling.

Afterwards the orientation was examined, and the four cardinal points checked by means of an azimuth compass, the results being satisfactory.

The rain gauge was also examined, but the clock was in such excellent order that it only required oiling. "Squeezes" were taken of the funnels of both the Beckley and spare gauges.

The corrections to the standard thermometers at 50 degrees were found to be, as compared with Kew standard No. 571, for the dry, No. 458, 0°·0, and for the wet, No. 395, −0·55.

After testing, the graduations of the thermometers were re-blackened.

Valencia.—The barograph and thermograph at this observatory were in a very satisfactory condition, but at the same time I considered it desirable to clean both clocks, as well as the lenses and other parts generally.

With regard to the slight blurring in the wet bulb trace of the thermograph, it seems only to occur when the temperature ranges between 35 to 45 degrees, and is probably due to some accidental roughening of the glass at that part of the tube, as already pointed out by Mr. Whipple; but in consequence of the great risk attendant on taking the thermometer out of its fittings I did not think it advisable to dismount the tube in order to make a closer examination.

The photography at the time of my visit was good.

The corrections to the standard thermometers at 58 degrees were determined to be, as compared with Kew standard No. 574, for the dry, No. 399, −0·6, and for the wet, No. 398, −0·45; after testing, the graduations of the thermometers were re-blackened.

Anemometer.—The external parts of the anemometer were entirely dismounted and thoroughly cleaned and oiled.

The cups and stays supporting the arms are, however, in a very shaky and unsatisfactory condition. I would therefore most respectfully beg to draw the special attention of the Council to Mr. Whipple's report on this instrument last year.

The orientation was examined, and the result is appended to this report; also the four principal points were checked by means of an azimuth compass, and found to agree with the marks used by Mr. Cullum for the purpose of orienting.

The rain gauge was taken to pieces and cleaned, and a new line was attached to the clock; as regards the attachment of the papers to the drum, Mr. Cullum experiences considerable difficulty, as the sheets are cut much wider than the cylinder itself.

(Signed) T. W. Baker.

Report on the Instruments at Kew Observatory.

The anemograph was entirely dismounted and thoroughly cleaned on August 23rd. During the year the cap on the oil cup of the velocity shaft has been observed on several occasions to work loose, and so cause a creaking noise for a short time. It is intended to fit a tightening screw to it as soon as a convenient opportunity of so doing presents itself.

The working parts of the instrument show very few signs of wear, although it has now been running more than 15 years.

After remounting, it was again oriented, and a slight displacement of the sheet upon the cylinder was found necessary.

Barograph.—This instrument was cleaned on August 7th. It is in perfect order and required no repairs beyond a new clock line. During the holidays of the photographic assistant, Morgan's gelatino-bromide paper was used for both first and second sheets, as the photographic operations it entails are so trivial as contrasted with those of the waxed paper process. The only objection to its continued employment lies in the fact that owing to its contractile coating it possesses a strong tendency to curl, which cannot be overcome. This sometimes causes bagging when two sheets are put on together, and the light diffusing in the space between them, the trace on the under sheet becomes blurred. Attempts are being made to overcome this defect.

Thermograph.—The Kew thermograph was dismounted, its clock and lenses cleaned, and a new cord attached to the former.

In accordance with a request contained in a letter from the Meteorological Office, dated July 30, an attempt was made to improve the definition of the wet bulb trace. The defect being due to an apparent

excessively wide slit, the tube was re-blackened and a new and narrower slit made. Using, however, the gelatinised paper, it became evident that a good deal of stray light found its ways through the blackening, and on the return of Mr. Baker, the thermometer was again taken out, cleaned, and re-blacked on October 8th. This operation was not successful, and on the 9th it was repeated, and found that owing to the narrowness of the bore it was extremely difficult to admit light to the air speck whilst excluding it from sides of the tube, the tube itself acting as a cylindrical lens. In these operations the shield was of necessity removed from the tube, and the zero values will probably experience a slight change.

The dry-bulb thermograph tube was not touched in the above experiment, and its zero values remain at 80·6 degrees for the upper and 22·1 for the lower.

The standards were tested as usual in ice at the beginning of the year, and the folloming corrections were then determined :—

Dry bulb, No. 378, — 0°·4. Wet bulb, 473, — 0°·4

The rain gauge was cleaned and clock line renewed on June 18, being found in perfect order..

The sunshine recorder is also in good order, the sphere being cleaned from time to time as required.

(Signed) G. M. WHIPPLE.

APPENDIX VIII.

METHOD of DEALING with TELEGRAPHIC WEATHER INTELLIGENCE.

The operations connected with the preparation and issue of the Forecasts and Storm Warnings have not been materially changed during the year, but the form of the Daily Weather Report has been changed to a large quarto (instead of foolscap), and new values have been calculated for the means of pressure, temperature, and rainfall given in the margin, and the mean temperature of evaporation at 8 a.m. has been added to them.

The Office still receives, when the telegraphic communications are perfect, fifty-three reports every morning, thirteen every afternoon (except on Sundays), and nineteen each evening. The interruptions which have occurred at times in the communication with Sumburgh Head and Stornoway have again been serious, owing to the severity of the gales which occurred during the winter. The suspension of the afternoon reports on Sundays is due to the fact that almost all the telegraphic circuits are closed at the hours at which the messages would be transmitted. The instructions to the observers have not been altered during the year, and the system of observing cirrus cloud has not been materially extended.

The foreign reporting stations, 23 in number, extend along the entire western coast of the Continent, from Bodö in lat. 67° N. to Corunna in lat. 43° N., and include four stations on the coast of the Baltic, and one in the Mediterranean. The information is received in accordance with arrangements made with the various Meteorological organisations in France, Holland, Germany, Denmark, Norway, and Sweden.

At the British stations the morning observations are taken at 8 a.m. Greenwich time, and most of the telegrams arrive in London at about 9 o'clock, when the Intelligence Department of the Post Office extracts from them the portions required for its wind and weather reports. They are then transmitted to the Meteorological Office by its private wire, where the majority of them usually arrive between 9 a.m. and 10 a.m.

As fast as the reports come in, the information is entered on a chart, which shows for each station at 8 a.m. the barometrical and thermometrical readings, with their respective alterations during the preceding 24 hours, the direction and force of the wind, and the state of the weather, together with any changes of importance which may have been noticed in the course of the preceding day. From this chart, which is preserved in the Office, other charts are drawn for publication in the newspapers, as described further on.

If necessary, telegraphic intelligence of storms or of atmospherical disturbance is immediately sent to our own coasts and to foreign countries. A brief telegraphic resumé of the weather is despatched shortly after 11 a.m. to the Harbour Authorities in Jersey. Another telegraphic message, of about 75 words, is sent to the Underwriters' Association, Liverpool, containing reports of the pressure, wind and weather at 14 stations on the coasts of the British Islands; and a third message of about the same length is forwarded to the Central News for despatch to the provinces. The last of these messages consists of a brief statement of the general condition of the weather in Western Europe, as shown by the reports for the morning.

It is, however, not only in the morning that storm warnings are issued to the coasts, for a constant watch is kept during the day, and whenever on the receipt of the regular or of special telegrams the condition of the weather appears to be threatening, cautionary messages are at once issued to such parts of the coast as are thought to be menaced by a gale.

During the year 1884, there were prepared each morning, afternoon, and evening, Forecasts of the weather, for one day in advance; these were drawn up for eleven districts in the British Islands, and issued to subscribers, to certain Clubs, and to many of the London and Provincial newspapers in accordance with the arrangements referred to on p. 13. The districts for which the Forecasts were prepared were those into which the returns for the Weekly Weather Report are divided, with the addition of Scotland, N., viz. :—

0. Scotland, N.
1. „ E.
2. England, N.E.
3. „ E.
4. Midland Counties.
5. England, S.
6. Scotland, W.
7. England, N.W. (with N. Wales).
8. England, S.W. (with S. Wales).
9. Ireland, N.
10. „ S.

The demand for these Forecasts is still considerable, and efforts are constantly being made to increase their accuracy.

About an hour and a quarter is occupied in the preparation and transmission of the provincial and foreign telegrams, and in the drawing up of the "Remarks" and 11 a.m. Forecasts for the London newspapers, so that the MS. copies for the "Times" and other papers are ready for issue soon after 11 a.m.

The Charts prepared daily for newspaper publication are as follows:—

For the "Times," - -	two daily, viz.:	for 8 a.m. and 6 p.m.
For the Patent Type-founding Company, on behalf of the "Shipping Gazette," and for distribution to the provincial press -	one „	for 8 a.m.

The 8 a.m. charts are sent out at about 10.15 a.m. and the 6 p.m. chart at about 8.30 p.m.

The draft of the Daily Weather Report (in its improved form), with two charts attached, is drawn on transfer paper, and is ready by noon, when it is at once sent to the lithographer to be printed. The copies for delivery by hand in London are issued by the lithographer at about 1.30 p.m., while the remainder are received at the Meteorological Office at about 3.30 p.m., whence they are transmitted by post to the subscribers and others.

In addition to the charts referred to above, the Patent Type-founding Company are supplied with various diagrams showing the changes in pressure, temperature, rainfall, wind, and weather for the London district. These are engraved *daily* for the "Daily Chronicle," *weekly* for the "Observer," and "Graphic," and *monthly* for the "Miller." They are all accompanied by remarks on the phenomena exhibited.

At about 3 p.m. the observations taken at eleven home stations at 2 p.m. are received, and those for two foreign stations (Skudesnaes and Rochefort) come in afterwards. Copies of these reports are issued, together with the 8 a.m. report, to certain newspapers and subscribers. Two copies of the "Remarks" (8 a.m. and 2 p.m.) are sent to the Type-founding Company for issue to provincial newspapers for publication, in order to explain the 8 a.m. charts.

From 7 to 7.30 p.m. the nineteen evening (6 p.m.) reports arrive and are charted and discussed for the morning daily papers in accordance with the arrangement referred to on p. 13. The forecast and remarks are usually ready by 8.30 p.m., but in bad weather, owing to the delay of the reports and the additional care which is necessary in dealing with them, it is frequently 9 p.m. before they are issued. The "Times" still publishes the daily map showing the distribution of pressure, the winds, temperature, and rainfall at 6 p.m., the importance of which can hardly be over-estimated.

The official charts for 2 p.m. and for 6 p.m. are still much less complete than that for 8 a.m. That for 2 p.m. is drawn on the information received from eleven home stations, supplemented by two foreign ones, whenever the latter arrive in time to be used. The material for the 6 p.m. charts is now supplied by reports from fifteen stations in the United Kingdom, supplemented by four from continental stations, but the latter frequently arrive late at the very time when they are most wanted, *i.e.*, during bad weather.

The Sunday duty is still conducted as follows:—Two of the clerks attend on Sunday mornings at the Central Telegraph Station from 8.30 a.m. to about 10.15 a.m. By an arrangement with the Post Office these clerks are supplied with the telegrams immediately they arrive in London. They are examined and charted, with the view of issuing, when necessary, warnings of coming storms, to our own and neighbouring coasts. It is necessary that promptitude should be observed in this service, as the observations must be dealt with and the warnings issued so that the latter may reach the coast before the telegraph offices close for the day, which is usually at about 10 a.m. No work of any kind

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is transacted for the newspapers on Sunday mornings, the main object of the service being to give prompt information of storms to our coasts; but a telegram is sent to Jersey in the same way as on week days, and there is the ordinary interchange of messages with foreign countries. At 6 p.m. the same clerks attend at the Meteorological Office to receive the evening reports and to prepare the 8.30 p.m. Forecasts, and another opportunity is thus offered for the correction or extension of any warnings which may have been issued in the morning.

Daily Weather Report.

A considerable change has been made in the form of the Daily Weather Report since 1st January 1884. The information now fills four large quarto pages, and is arranged as follows:—

Page 1 contains the whole of the reports from which the maps for the day (given on page 2) are prepared; and also the 6 p.m. reports of the previous day; page 2 contains (1) a map of North-western Europe showing for 8 a.m. on the date of publication the distribution of pressure, the prevalent winds, and the sea disturbance, with necessary explanations; together with a table showing the mean pressure of the atmosphere for the month at 22 stations; (2) a similar map showing the distribution of temperature, the weather at each station, and the distribution of rainfall during the past 24 hours; together with tables of mean temperature of the air and of evaporation at 8 a.m. and the mean rainfall for the month at a large number of stations over the United Kingdom.

Page 3 contains (1) remarks on the principal features exhibited by the reports for the day; and (2) the forecasts drawn up for each district at 11 a.m. relating to the weather likely to be experienced during the 24 hours ending at noon on the day after that of publication.

Page 4 contains the reports and remarks for 2 p.m. on the previous day, and there is space for the insertion of a Weekly Summary on Mondays, and any other brief information which it is deemed necessary to print at once.

The standing portion of the report (the maps, &c.) is printed in blue, while the information for each day is in black.

Weekly Summary.

On each Monday a brief Summary of the Weather which has been experienced over our Islands during the preceding week is given on p. 4 of the Daily Weather Report. It refers only to the principal changes which have occurred, and is intended to serve as an aid to the study of the Daily Reports.

In this manner the main meteorological features of the week are presented as a connected story, and additional facility is afforded for future reference.

Correction and Addition List.

Additional steps are taken to insure accuracy in the Daily Weather Report. At the close of each month a return is received from nearly all of the telegraphic reporting stations, containing a copy of all the observations which have been transmitted to London by wire during the month. These schedules are used for checking the daily telegrams, for the preparation of the average and other values of the different elements, and also as evidence in the case of legal proceedings; and about

the middle of every month a lithographic sheet has for many years past been issued with the Daily Weather Report, containing corrections for all discrepancies which have been discovered, and supplying any observations which have been omitted in the published reports. This monthly sheet also contains tables showing the mean values for pressure, temperature, and humidity, together with the total rainfall, and the prevalence of various kinds of weather and of winds from each of the eight principal points during the month, for each telegraphic reporting station within our islands.

Weekly Weather Report.

The Weekly Weather Report has appeared since the beginning of February 1878. It consisted originally of four pages octavo, but has now been enlarged to four pages quarto, and has been considerably improved. The Report now contains the average and extreme temperatures and the rainfall values and the total amount of bright sunshine in each week, for ten districts in Great Britain and Ireland, together with the difference between them and their respective mean values for the corresponding weeks in previous years. In addition to this, the values for Accumulated Temperature, Rainfall, and Bright Sunshine are given, both for the week and for the whole period since January 1st.

The Accumulated Temperature is designed to give persons engaged in agriculture better means of estimating the manner in which vegetation is affected by temperature than that afforded by the more usual methods of treating the readings of the thermometer. It shows for the week, and for the whole period from the 1st January of each year, the weekly and progressive values respectively, of the combined amount and duration of the excess or defect of the air temperature, above or below a suitably fixed standard or *base temperature*. The base adopted is 42° F., as being nearly equivalent to 6° Cent., which has been considered by Continental writers on these subjects to be the critical value, the temperature above which is mainly effectual in starting and maintaining the growth, and in completing the ripening, of agricultural crops in a European climate. This base is also convenient as being 10° F. above the Freezing Point.

The accumulated Temperature is expressed in Day-degrees; a Day-degree signifying 1° F. of excess or defect of temperature above or below 42° F. continued for 24 hours, or any other number of degrees for an inversely proportional number of hours.

It has been ascertained by calculation from a considerable series of hourly observations at various places, that the accumulated temperature may be computed, with a very tolerable approximation to the truth, from the observed daily maximum and minimum temperatures alone.

When the temperature during any period remains either wholly above or below the base temperature, the difference between the base and the mean temperature gives the correct accumulated temperature. In other cases this difference gives a value which does not depart greatly from the truth, the deviation depending on the greater or less extent of the variations of the temperature above or below the base. Further, since the mean between the maximum and minimum of any day is nearly equal to the mean temperature of the day, the difference of the mean of the maximum and minimum from the base will give directly a fair approximation to the accumulated temperature for the day.

The following rules will supply a close approximation to the true values sought, and they have been adopted in the preparation of the table in the Weekly Weather Report. They may be applied to any

other base temperature as well as to 42° F., with the slight modification of the numerical coefficients mentioned in the last rule.

RULES for computing the ACCUMULATED TEMPERATURE above or below 42° F. from the observed MAXIMUM and MINIMUM.

1. Multiply the difference between the maximum and minimum by the proper coefficient for the month shown, and the result will be the difference between the mean temperature for the day and the minimum.

2. Then the accumulated temperature will be obtained as follows :

Conditions of Temperature	Accumulated Temperature.	
	Above 42° F.	Below 42° F.
If the minimum is *above* 42° F. or *equal* to 42° F.	Add to the difference between the mean for the day and the minimum the excess of the minimum over 42° F.; or subtract 42° F. from the mean for the day.	None.
If the minimum is *below* 42° F., but the mean for the day is *above* 42° F.	From the difference between the mean for the day and the minimum deduct the accumulated temperature below 42° F.	Four-tenths of the excess of 42° F. over the minimum.
If the mean for the day is *below* 42° F., but the maximum is *above* 42° F.	Four-tenths of the excess of the maximum over 42° F.	From the difference between the mean for the day and the minimum deduct the accumulated temperature above 42° F.
If the maximum is *below* 42° F., or *equal* to 42° F.	None.	From the excess of 42° F. over the minimum deduct the difference between the mean for the day and the minimum; or subtract the mean for the day from 42° F.

3. The quantities thus obtained must be multiplied by the number of days in the period, that is by 7 *for a weekly period.*

4. The multiplier in Rule 2 for a weekly period, if the base temperature be 32° F. or 42° F., is 0·4; if 52° F. it is 0·33; if 62° F. it is 0·25.

A full explanation of these rules will be found in Appendix II. to the Quarterly Weather Report for 1878.

The temperature means derived from the daily maxima and minima are corrected so as to agree as closely as possible with the true mean daily value, and the average values for the corresponding period in former years have been recomputed, those now in use being :—

For Temperature	- -	20 years 1861–80
„ Rainfall	- -	15 „ 1866–80

These statistics are given on page 1 of the publication, the temperature, rainfall, and sunshine values for *each station** being given on page 4. In addition to the telegraphic reports, and the returns from the self-recording observatories, weekly returns from 34 volunteer

* The sunshine values are furnished for only a limited number of carefully selected stations.

observers are used in preparing this report, the names of the observers at each station being as under—

Names of Stations.	Names of Authorities.
Alnwick Castle - - -	Major F. Holland, for the Duke of Northumberland, K.G.
Arlington (N. Devon) - -	J. Carter, for Lady Bruce-Chichester.
Bawtry (Hesley Hall) - -	B. I. Whitaker, F.R. Met. Soc.
Birmingham (Oscott) - -	Rev. J. W. Browne, St. Mary's College.
Blackpool - - - ℳ	C. T. Ward, F.R. Met. Soc.
Brookeborough - - -	Mr. Ferguson, for Sir Victor Brooke, Bt., F.L.S.
Cheadle - - - ℳ	J. C. Philips, F.R. Met. Soc.
Churchstoke - - - ℳ	P. Wright, F.C.S., F.R. Met. Soc.
Cirencester - - - -	The Royal Agricultural College.
Cullompton - - - ℳ	T. Turner, J.P., F.R. Met. Soc.
Douglas (Isle of Man) - -	A. W. Moore, F.R. Met. Soc., Cronkbourne
Dublin - - - -	J. W. Moore, M.D., F.R. Met. Soc.
Durham - - - -	G. A. Goldney, the Observatory.
Foynes - - - -	T. J. Carey, for Lord Monteagle.
Geldeston - - - -	E. T. Dowson, F.R. Met. Soc.
Hastings (St. Leonard's) - -	H. Colborne, M.R.C.S.
Hereford - - - ℳ	T. A. Chapman, M.D., F.R. Met. Soc.
Hillingtoh - - - ℳ	Rev. H. E. B. Ffolkes, M.A., F.R. Met. Soc.
Kilkenny - - - -	H. Carlton, for the Marquis of Ormonde.
Laudale (Loch Sunart) - -	A. Fletcher, for T. H. G. Newton, F.R. Met. Soc.
Leicester - - - -	J. C. Smith, the Museum.
Llandudno - - - ℳ	J. Nicol, M.D., F.R. Met. Soc.
Londonderry - - -	J. Conroy, F.R. Met. Soc.
Manchester (Prestwich) - -	T. R. H. Clunn, M.D.
Markree Castle (Sligo) - -	A. Marth, F.R.A.S., for Colonel Cooper, F.R.A.S.
Marlborough - - ℳ	Rev. T. A. Preston, M.A., F.R. Met. Soc.
Newton Reigny (Penrith) - -	T. G. Benn, F.R. Met. Soc.
Plymouth - - - -	J. Merrifield, LL.D., F.R.A.S.
Rothamsted - - -	Rainfall by Sir J. B. Lawes, Bart., LL.D., F.R.S., and J. H. Gilbert, Ph.D., F.R.S., temperature by T. Wilson, F.R. Met. Soc.
Scarborough - - ℳ	A. Rowntree, F.R. Met. Soc.
Silloth - - - -	Rev. F. Redford, F.R.S.E.
Southampton - - -	J. T. Cook, R.E., Ordnance Survey Office.
Strathfield Turgiss - - ℳ	Rev. C. H. Griffith, F.R. Met. Soc.
Waterford (Brook Lodge) - -	C. Percival Bolton, F.R. Met. Soc.

The returns marked "ℳ" are supplied through the Royal Meteorological Society.

The report is prepared on Wednesday in every week, and is ready for sale early on Saturday morning, but the summary on its first page is sent to the "Times," "Daily News," and some other papers on Wednesday evening.

A *Quarterly Summary* of the Weekly Weather Report is also issued, giving for each of the 12 districts before referred to (1) the Mean Temperature for the Quarter in each year since the year 1878 inclusive, and the means for certain groups of years; (2) the Total Rainfall for the Quarter in each of the same years; and (3) the Accumulated Temperature, Rainfall, and Bright Sunshine for the Quarter.

Issue of Forecasts.

Descriptions of the actual state of the weather, and forecasts *for not more than one day in advance*, are prepared at the Meteorological Office as under:—

On Week Days.

(1.) At 11 a.m. (from the morning reports), for the 24 hours ending at Noon on the day following the date of issue. This issue is intended especially for the early editions of the evening papers, for the clubs, and for exhibition at certain selected stations. See p. 13.

(2.) At 3.30 p.m. (from the morning and afternoon reports), for the day following that of issue. This set of Forecasts is not intended for general publication, but a copy is exhibited regularly at the door of the Meteorological Office.

(3.) At 8.30 p.m. (from the 6 p.m. reports), for the day following that of issue. These are now supplied gratis to any newspaper or news agency which may apply for them, and send for them regularly. A very large number of the most important papers avail themselves of this advantage.

The forecasts are made for the following districts:—

0. Scotland, North.
1. Scotland, East.
2. England, N.E.
3. England, East.
4. Midland Counties.
5. England, South
6. Scotland, West (with Isle of Man).
7. England, N.W. (with North Wales).
8. England. S.W. (with South Wales).
9. Ireland, North.
10. Ireland, South.

The descriptions and forecasts are posted at the doors of the Meteorological Office, 116, Victoria Street, S.W., on week days, for the inspection of the public. Copies, or extracts from them, are communicated under the conditions stated below, but no information which is not substantially included in them can be supplied.

Forecasts for Private Subscribers.—Any person can be supplied with a copy of the 11 a.m. Forecasts, once on each week day,* on payment of a subscription of ten shillings per annum, *in addition to the cost of transmission;* the charges will therefore be, by *letter* post, 9*s.* per quarter, by *book* post, 5*s.* 9*d.*

* Good Friday and Christmas Day are reckoned as Sundays.

FORECASTS FOR CLUBS.—Forecasts, drawn up at 11 a.m., for all the districts, are supplied to Clubs, for a subscription of ten shillings per annum. These are delivered free, by hand, to Clubs situated in or near Pall Mall. Special arrangements can be made for delivery at a greater distance by hand or by post.

SUBSCRIBERS FOR THE LITHOGRAPHED COPY OF THE DAILY REPORT have the 11 a.m. Forecast incorporated with their Report on each week day. The subscription for the Report is—

For delivery by hand, where feasible, £2 per annum;
Do. by book post £1 „

N.B.—Subscriptions must be paid in advance, and end at the usual official quarter day. The subscription for any part of an official quarter is charged as a complete quarter.

Unless otherwise arranged, all forecasts transmitted by post are sent by book post, not as letters.

INQUIRIES as to the WEATHER.

INQUIRIES PERSONALLY OR BY MESSENGER.—Any person applying at the Meteorological Office between 11 a.m. and 8 p.m. on week days, and between 6.30 p.m. and 8 p.m. on Sundays, can be supplied in writing with the latest information in the possession of the Office and with the latest forecast issued for any specified district, on payment of one shilling for each inquiry.

INQUIRIES BY LETTER.—Application may be made by letter, enclosing thirteen pence in stamps if the reply is to be *by post*, and two shillings in stamps if the reply (not exceeding twenty words) is to be *by telegraph.*

INQUIRIES BY TELEGRAPH.—Any person may obtain *by telegraph* from the Meteorological Office the latest information as to the weather in any district of the United Kingdom by payment of a fee of 3*s.* The telegram containing the inquiry must not exceed 20 words in length, and must be addressed to the

METEOROLOGICAL OFFICE,
LONDON.

Application may also be made for similar information to be sent either *by telegraph* or *post* on some future specified day.

CHECKING of FORECASTS.

In order to test the accuracy of the forecasts they have been compared carefully with the weather reported in the various districts on the days to which they referred, and the results of this checking have been already given in the Report (p. 13).

In carrying out this comparison the portions of the forecasts which referred to wind have been carefully separated from those relating to weather. The final results of the comparison will be found in Appendix XII., p. 76.

CHECKING of STORM WARNINGS.

The testing of the warnings is conducted in the following manner: The intelligence issued is compared with the weather experienced on the coasts, as indicated by the various self-recording anemometers, by the telegraphic reporters, and by the several gentlemen who have volunteered to observe for the Office, and whose names will be found in App. XV., p. 87.

In order to render the information in the possession of the Office as to the weather experienced on our coasts still more complete, the Council have, as in preceding years, made application to the various Light-house Boards, and have obtained from them the original log-books from some of the most exposed lightships and lighthouses. They would here express their cordial thanks for the co-operation so readily granted to them by these Boards.

The result of the checking for 1883 will be found on p. 16.

The coasts are subdivided into nine districts, as will be seen in the table. Two large tracts of coast are entirely omitted: The west of Ireland from the Shannon to Malin Head, and the West of Scotland from the Mull of Cantyre to Cape Wrath. No warnings are issued to any place within the limits indicated, except to Galway, and the amount of information as to the weather received from the omitted tracts of coast is, as yet, very scanty.

It should be remembered that in analysing the reports, all observations of the wind in which the force *exceeded* 7 (a "moderate gale") or the velocity exceeded 40 miles an hour, have been quoted as instances of the occurrence of a gale; but it has not been considered that the signal was hoisted late or was hauled down too soon, unless the force of 9 (a "strong gale") or the velocity of 50 miles an hour, was reached prior to the issue of the order to hoist, or subsequent to the issue of the order to lower.

In the Summaries all cases in which the signal has been shown to be late by a single report either of force 9, or of a velocity of 50 miles an hour, have been specially noted.

APPENDIX IX.

LIST of PERSONS, PLACES, &c. to which the Daily Weather Report is supplied, free of cost.

Newspapers:

Knowledge.
Lloyd's Shipping List.
New York Herald.
Times (1st and 2nd editions, with charts).

For Exhibition at following Seaports:

Banff.
Barrow-in-Furness.
Belfast.
Blackpool.
Bo'ness.
Boscastle.
Brighton.
Briton Ferry.
Broughty Ferry.
Buckie.
Budehaven.
Caernarvon (2 copies).
Cork.
Cowes.
Cromer.
Cullercoats.
Deptford Yard.
Dover.
Dundee Harbour-master.
Exeter (2 copies).
Falmouth.
Glasson Dock.
Great Grimsby (2 copies).
Groomsport.
Hastings.
Hayle.
Holyhead.
Kingstown.
Lancaster.
Leith.
Lowestoft.
Margate.
Morecambe.
Nairn.

For Exhibition at following Seaports—cont.

Newquay.
Penarth.
Plymouth.
„ G. W. Docks.
Port Dinorwic.
Porthcawl.
Queenstown.
St. Sennen Cove.
Scarboro'.
Silloth.
Southport.
Teignmouth.
Ventnor (2 copies).
Weston-super-Mare.
Wick.
Wisbech.
Yarmouth.

In exchange for Observations:

Aird, G. H., Seaham.
Barnstaple Meteorological Committee.
Bellingham, J. G., Saffron Walden.
Benn, T. G., F.R. Met. Soc., Newton Reigny.
Berridge, W., F.R. Met. Soc., Loughborough.
Cambridge Observatory.
Chatham, The Instructor in Surveying. (2 copies.)
Clark, J. E., York.
Clouston, Rev. C., LL.D., Sandwick, Orkney.
Colborne, H., M.R.C.S., St. Leonards-on-Sea.
Conroy, J., F.R. Met. Soc., Londonderry.
Cooper, Col., F.R.A.S., Markree, nr. Sligo.
Cooper, W. F., Sheffield.
Davis, T. H., F.R. Met. Soc., Peel, Isle of Man.
Dowson, E. T., F.R. Met. Soc., Geldeston, Beccles.
Durham, University Observatory.
Glenalmond, Trinity College.
Greenwich Observatory.
Leicester Museum.
Liverpool Observatory.
McCormack, J., Aberdeen.
Mellish, H., F.R. Met. Soc., Worksop.
Moore, A. W., F.R. Met. Soc., Isle of Man.
Moore, F. W., Glasnevin, Dublin.
Moore, J. W., M.D., F.R. Met. Soc., Dublin.
Mullins, Rev. G. H., F.R. Met. Soc., Uppingham.
Northumberland, Duke of, Alnwick.
Ordnance Survey Office (Southampton).
Pearson, Rev. J., M.A., F.R.A.S., Fleetwood.
Prestwich Asylum, near Manchester.
Propert, W. P., LL.D., F.R. Met. Soc., St. David's.
Radcliffe Observatory, Oxford.
Richards, W. H., Penzance.
Rosse, Earl of, F.R.S., Parsonstown.
Royal Indian C.E. College, Cooper's Hill.
Rugby Natural History Society.
St. Mary's College, Oscott.
Southport, Fernley Observatory.
Stow, Rev. F. W., M.A., F.R. Met. Soc., Aysgarth, Bedale.
Vibert, J. E., M.A., St. Aubin's, Jersey.
Ward, Rev. B., Ware.
Yorkshire Philosophical Society.

Government Offices:

Admiralty: 12 copies.
Aldershot, Garrison Library.
Army Medical Department.
Army Medical Department, Woolwich.
Board of Trade: 3 copies.
"Britannia," H.M.S., Dartmouth.
Commons, House of.
Devonport Dockyard: 2 copies.
„ Commander-in-Chief.
„ Captain of Steam Reserve.
„ Master Attendant.
Farnborough Station, Staff Commandant's Clerk.
Dublin, Registrar General.
Greenwich, R.N. College.
"Indus," H.M.S., Devonport.
Ireland, Royal College of Science.
Lords, House of.
Mann, J. R., Osborne.
Medical Department of the Navy.
"Nankin," H.M.S., Milford Haven.
Portland, Senior Naval Officer.
Portsmouth, Commander-in-Chief.
„ Dockyard.
„ R. N. College Observatory.
Queenstown, Rear-Admiral.
Registrar General.
„ „ of Seamen.
"Resistance," H.M.S., Rock Ferry.
Royal Military Academy.
Sandhurst Staff College.
Science and Art Department: 2 copies.
Sheerness, Commander-in-Chief.
„ Dockyard.
War Office, Adjutant General, Horse Guards.
„ Commander-in-Chief.

Societies, &c.:

Association of Underwriters, Liverpool.
Do. Lloyd's.
British Museum.
Buchan, A., F.R.S.E., Edinburgh.
Crossley, Mrs., Halifax.
Griffith, Rev. C. H., Strathfield Turgiss.
Jackson, H. Kains, London.
Ley, Rev. W. C., M.A., Lutterworth.
Meteorological Council: 4 copies.
Miller, S. H., F.R.A.S., Lowestoft.
Observatories: 7 copies.
Richards, Vice-Adm., Sir G. H., F.R.S., London.
Royal Society.
Royal Meteorological Society.
Scottish Meteorological Society.

Foreign Places:

Algiers, Meteorological Service.
Bombay, Observatory.
Brussels, Royal Observatory.
Cairo, Laboratoire Khédivial.
Calcutta, Meteorological Department.
Chemnitz, Meteorological Service of Saxony.
Christiania, Meteorological Institute.
Constantinople, Imperial Meteorological Observatory.
Copenhagen, Meteorological Institute.
Cracow, Observatory.
Florence, Museum.
Freeden, W. H. v., Bonn.
Hamburg, Deutsche Seewarte.
Lisbon, Observatory.
Madrid, Royal Observatory.
Melbourne, Observatory.
Paris, Central Meteorological Bureau.
„ Meteorological Observatory, Montsouris.
„ Meteorological Society.
„ Ministry of Marine.
Rome, Meteorological Institute.
San Fernando, Observatory.
St. Petersburg, Central Physical Observatory.
Stockholm, Meteorological Institute.
Tiflis, Physical Observatory.
Toronto, Meteorological Office.
Upsala, University Observatory.
Utrecht, Royal Meteorological Institute.
Vienna, Imperial Meteorological Institute.
Washington, Smithsonian Institution.
„ United States Naval Observatory.
„ Chief Signal Officer, War Office.
Zürich, Central Meteorological Institute.

APPENDIX X.

Fishery Barometers.

List of Places supplied with Fishery Barometers.

Shetland Isles.—Balta Sound, Uya Sound, Lerwick, Sandsair, Symbister, Scalloway.

Orkney Isles.—Burray. Kirkwall.

Scotland, east coast.— Stroma, Keiss, Staxigoe, Wick, Sarclet, Lybster, Dunbeath, Portmahomack, Cromarty, Avoch, Nairn, Burghead, Portessie, Port Knockie, Portsoy, Whitehills, Gardenstown, Rosehearty, Pitullie, Inverallochy, Pointlaw, Port Erroll, Findon, Portlethen, Muchals, Stonehaven, Arbroath, Broughty Ferry, St. Andrews, Crail, Cellardyke, St. Monance, Burntisland, Newhaven.

England, east coast.—Berwick, Beadnell, North Shields, South Shields, West Sunderland, Hartlepool, Staithes, Scarborough, Filey, Flamborough, Bridlington Quay, Withernsea, Hull, Lynn (2), Wells, Gorleston, Harwich, Brightlingsea, Wivenhoe, Margate, Deal (2), Kingsdown, Dover.

England, south coast.— Bognor, Portsea, Ryde and Ventnor (2) (Isle of Wight), Gorey (Jersey), Haslar Hospital, Poole, Weymouth, Portland, Budleigh-Salterton, Cawsand, Charlestown, Mevagissey, Gorranhaven, Devoran, Portscath, Penryn, Durgan, Porthallow, Falmouth, Coverack, Newlyn, Mousehole.

England, south-west coast.— St. Ives, Hayle, Padstow, Port Isaac, Boscastle, Fremington, Burnham, Highbridge, Weston-super-Mare.

Wales.—Briton Ferry, Swansea, Angle, Milford, Abersoch.

England, north-west coast.—Fleetwood, Morecambe, Maryport.

Isle of Man.—Douglas, Port St. Mary, Peel.

Scotland, south-west coast.—Port Patrick, Stranraer.

Ireland, east coast. — Cushendall, Belfast, Bangor, Groomsport, Donaghadee, Strangford, Ardglass, Carlingford, Greenore, Dundalk, Malahide, Howth, Kingstown (2), Bray.

Ireland, south coast.—Dunmore, Dungarvan, Crosshaven, Kinsale, Union Hall, Castletownsend, Baltimore, Schull, Crookhaven.

Ireland, west coast.—Port Magee, Valencia, Dingle, Tralee, Tarbert, Kilcredane, Barna, Elly Bay, Ballyglass, Ballycastle (Co. Mayo), Donegal, Tribane, Killybegs, Teelin, Portnoo, Burton Port, Bunbeg.

Ireland, north coast.—Dunfanaghy, Rathmullen, Buncrana, Greencastle, Portrush, Portstewart.

Scotland, west coast.—Tarbert, Campbeltown, Carradale, Portree (Isle of Skye), Plockton.

Hebrides, Stornoway, Cromore, Babyle, Obb, Ness.

SUMMARY of STATIONS supplied with INSTRUMENTS.

England and Wales - - - - - -	67
Scotland - - - - - - -	54
Ireland - - - - - - -	47
	168

APPENDIX XI.

TELEGRAPHIC WEATHER INTELLIGENCE.

The following stations are supplied with telegraphic information of storms, free of expense, and signal "cones" have been furnished to most of them, all further expenses attendant on the maintenance and repair of the apparatus being borne locally. The stations are situated,

81 in England and Wales, 38 in Scotland, 15 in Ireland, 3 in the Isle of Man, and 3 in the Channel Islands.

NORTH.	WEST.	SOUTH.	EAST.
SCOTLAND. EAST COAST.	ENGLAND, N.W.	ENGLAND, S.W.	ENGLAND, E.
Lerwick.	Ramsey.	Ilfracombe.	Eyemouth.
Scalloway.	Douglas.	Barnstaple.	Berwick-on-Tweed.
Boddam.	Castletown.	Boscastle.	Tynemouth.
Kirkwall.	Silloth.	Port Isaac.	S. Shields.
Holborn Head.	Maryport.	Newquay.	Sunderland.
Wick.	Workington.	Hayle.	Middlesborough.
Inverness.	Whitehaven.	St. Sennen.	Redcar.
Nairn.	Barrow.	St. Just.	Whitby.
Burghead.	Morecambe.	Scilly.	Filey.
Lossiemouth.	Fleetwood.	Penzance.	Bridlington Quay.
Buckie.	Blackpool.	Falmouth.	Hull.
Portsoy.	Lytham.	Pendennis.	Goole.
Banff.	Southport.	Mevagissey.	Grimsby.
Fraserburgh.	Runcorn.	Plymouth.	Boston.
Peterhead.	Liverpool.	Teignmouth.	Sutton Bridge.
Aberdeen.		Exmouth.	Lynn.
Stonehaven.	ENGLAND, W.		Sheringham.
Montrose.			Cromer.
Broughty Ferry.	Port Penrhyn.		
St. Andrews.	Holyhead.		
Dundee.	Port Dinorwic.		
Anstruther.	Carnarvon.		
Pittenweem.	*Aberystwith.	ENGLAND, S.	ENGLAND, S.E.
Burntisland.	Milford.		
Grangemouth.	Pembrey.	Guernsey.	Yarmouth.
Bo'ness.	Swansea.	St. Helier's, Jersey.	Southwold.
Granton.	Lianelly.	Gorey, Jersey.	Ipswich.
Leith.	Briton Ferry.	Weymouth.	Harwich.
Newhaven.	Porthcawl.	Poole.	Chatham.
Fisherrow.	Penarth.	Cowes.	Sheerness.
Dunbar.	Cardiff.	Ryde.	Faversham.
Cove.	Newport.	Portsmouth.	
	Burnham.	Littlehampton.	
	*Bridgewater.	Brighton.	
		Newhaven.	
	IRELAND, E.	Hastings.	
		Rye.	
	Belfast.	Dover.	
	Donaghadee.	Margate.	
	Howth.		
	Kingstown.		
FIRTH OF CLYDE.			
Glasgow.	IRELAND, S. and W.		
Greenock.			
Rothesay.	New Ross.		
Campbelton.	Dunmore East.		
Girvan.	Dungarvan.		
Ballantrae.	Youghal.		
	Queenstown.		
	Passage.		
	Cork.		
	Kinsale.		
	Tralee.		
	Limerick.		
	Galway.		

* Telegrams (only) exhibited.

Circular No. 717.

TELEGRAPHIC WEATHER INTELLIGENCE.

Board of Trade, February 14th, 1874.

THE Board of Trade have been informed by the Meteorological Committee that they are now prepared to re-introduce the use of Admiral FitzRoy's signals (cones and drum) with slightly modified significations, and that the change will take effect on and after 15th March 1874.

The signals to be used will consist of:—

1°. Cone, point downwards for Southerly gales; S.E. round by S. to N.W.

2°. Cone, point upwards for Northerly gales; N.W. round by N. to S.E.

3°. Drum, *with cone*, to indicate the probable approach of a *very heavy gale* from the direction indicated by the cone.*

The drum will not be used without the cone.

The signals are to be kept hoisted *during the daylight only*, until 48 hours have elapsed from the time *the telegram was despatched*, unless countermanded. At night, lanterns may be used wherever the local authorities deem it desirable to do so, as pointed out in the explanatory pamphlet† sent herewith, copies of which are supplied for gratuitous distribution.

It will be seen from the pamphlet in question that the meaning of the signals is that an atmospherical disturbance exists (which will be explained in the telegram), and will probably, but not *necessarily*, cause a gale at the place warned, *from the direction* indicated by the signal.

The Meteorological Office will supply the canvas shapes and lanterns to such places as require them, on loan, but in all cases the local authorities must undertake the charges incidental to the hoisting of the signal, such as flagstaff and gear, oil, &c., and also to the keeping of the apparatus in repair, painting, &c., as directed by the Circular No. 278, dated 30th November 1867.

THOMAS GRAY.

APPENDIX XII.

REPORT ON THE COMPARISON OF THE FORECASTS WITH THE WEATHER SUBSEQUENTLY EXPERIENCED, for the 12 Months, April 1883 to March 1884.

The letters used have the following signification:—

a = complete success. | **c** = partial failure.
b = partial (more than half) success. | **d** = total failure.

The checking has been conducted on the same system as that employed in previous years, *i. e.*, each forecast has been considered under the separate headings of "Wind" and "Weather," but the results of the 8 p.m. Forecasts only are here published.

The first column gives the percentage of success in "Wind," the second in "Weather," and the third the average of the two.

The Summary for the whole year is given at page 13.

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* The "drum" is not in use at present.

† The "explanatory pamphlet" referred to is a circular entitled "Telegraphic Weather Intelligence" printed in large type on four pages, so as to be posted up on a board.

Districts.		April 1883. Percentages. Wind.	Weather.	Average.	a+b.	May 1883. Percentages. Wind.	Weather.	Average.	a+b.	June 1883. Percentages. Wind.	Weather.	Average.	a+b.
Scotland, N.	a	53	60	57		55	58	57		43	50	47	
"	b	37	17	27	84	35	19	27	84	50	40	45	92
"	c	7	7	7		10	13	11		7	7	7	
"	d	3	16	9		0	10	5		0	3	1	
Scotland, E.	a	63	57	60		61	52	57		57	50	54	
"	b	27	37	32	92	29	13	21	78	37	30	33	87
"	c	0	3	2		7	16	11		3	3	3	
"	d	10	3	6		3	19	11		3	17	10	
England, N.E.	a	47	50	49		68	52	60		48	57	53	
"	b	33	23	28	77	23	26	25	85	45	23	34	87
"	c	17	27	22		0	6	3		7	7	7	
"	d	3	0	1		9	16	12		0	13	6	
England, E.	a	57	50	54		49	39	44		55	37	46	
"	b	27	33	30	84	42	32	37	81	33	40	39	85
"	c	3	7	5		3	26	15		7	10	9	
"	d	13	10	11		6	3	4		0	13	6	
Midland Cos.	a	53	43	48		58	48	50		43	50	49	
"	b	27	27	27	75	32	32	32	82	35	20	28	77
"	c	7	27	17		3	16	10		17	17	17	
"	d	13	3	8		7	10	8		0	13	6	
England, S.	a	43	50	47		58	45	52		52	44	48	
"	b	27	40	33	80	36	39	37	89	34	33	34	82
"	c	7	7	7		3	6	5		14	10	12	
"	d	23	3	13		3	10	6		0	13	6	
Scotland, W.	a	27	44	36		52	45	49		40	57	49	
"	b	47	33	40	76	42	26	34	83	40	37	38	87
"	c	13	10	11		3	19	11		17	3	10	
"	d	13	13	13		3	10	6		3	3	3	
England, N.W.	a	37	60	49		52	45	49		53	50	52	
"	b	47	30	38	87	35	19	27	76	37	24	30	82
"	c	3	3	3		10	23	16		10	13	12	
"	d	13	7	10		3	13	8		0	13	6	
England, S.W.	a	30	54	42		58	42	50		45	47	46	
"	b	40	40	40	82	32	39	36	86	41	23	32	78
"	c	20	3	12		7	10	8		7	13	10	
"	d	10	3	6		3	9	6		7	17	12	
Ireland, N.	a	30	60	45		55	49	52		48	60	54	
"	b	44	17	31	76	26	45	36	88	38	24	31	85
"	c	13	7	10		6	6	6		4	13	9	
"	d	13	16	14		13	9	6		10	3	6	
Ireland, S.	a	44	57	51		58	45	52		62	37	50	
"	b	33	23	28	79	26	42	34	86	21	40	30	80
"	c	10	3	6		3	7	5		10	13	12	
"	d	13	17	15		13	6	9		7	10	8	
Summary.													
British Isles	a	44	53	49		57	47	52		50	49	50	
"	b	35	29	32	81	32	30	31	83	38	30	34	84
"	c	9	10	9		5	13	9		9	10	9	
"	d	12	8	10		6	10	8		3	11	7	

Districts.		July 1883. Percentages. Wind.	Weather.	Average.	a+b.	August 1883. Percentages. Wind.	Weather.	Average.	a+b.	September 1883. Percentages. Wind.	Weather.	Average.	a+b.
Scotland, N.	a	58	42	50		26	42	34		63	40	52	
"	b	26	45	36	86	52	39	46	80	13	34	23	75
"	c	6	7	6		19	13	16		7	13	10	
"	d	10	6	8		3	6	4		17	13	15	
Scotland, E.	a	49	61	55		32	52	42		57	37	47	
"	b	42	13	28	83	45	29	37	79	23	43	33	80
"	c	6	20	13		16	6	11		7	7	7	
"	d	3	6	4		7	13	10		13	13	13	
England, N.E.	a	78	48	63		55	39	47		47	40	44	
"	b	19	26	23	86	35	36	36	83	33	40	36	80
"	c	3	16	9		7	6	6		7	10	9	
"	d	0	10	5		3	19	11		13	10	11	
England, E.	a	90	39	65		52	42	47		43	37	40	
"	b	10	45	27	92	39	39	39	86	40	40	40	80
"	c	0	16	8		6	6	6		7	13	10	
"	d	0	0	0		3	13	8		10	10	10	
Midland Cos.	a	71	48	60		52	29	41		50	33	42	
"	b	26	39	32	92	42	42	42	83	33	47	40	82
"	c	0	10	5		0	19	9		10	10	10	
"	d	3	3	3		6	10	8		7	10	8	
England, S.	a	87	55	71		62	45	54		47	33	40	
"	b	13	26	20	91	32	32	32	86	30	54	42	82
"	c	0	16	8		3	10	6		10	10	10	
"	d	0	3	1		3	13	8		13	8	8	
Scotland, W.	a	58	35	47		45	45	45		33	47	40	
"	b	32	29	30	77	35	36	36	81	30	37	34	74
"	c	3	10	7		10	13	11		17	3	10	
"	d	7	26	16		10	6	8		20	30	16	
England, N.W.	a	55	23	39		52	52	52		40	47	44	
"	b	32	48	40	79	32	29	31	83	40	27	33	77
"	c	10	16	13		13	13	13		7	10	9	
"	d	3	13	8		3	6	4		13	16	14	
England, S.W.	a	78	52	65		55	48	52		35	35	35	
"	b	16	45	31	96	29	20	24	76	34	45	40	75
"	c	3	3	3		3	19	11		14	17	15	
"	d	3	0	1		13	13	13		17	3	10	
Ireland, N.	a	42	42	42		55	55	55		57	59	58	
"	b	39	29	34	76	23	29	26	81	27	21	24	82
"	c	10	16	13		6	10	8		3	10	7	
"	d	9	13	11		16	6	11		13	10	11	
Ireland, S.	a	58	35	47		26	39	33		52	39	46	
"	b	23	52	37	84	52	39	45	78	21	25	23	69
"	c	6	10	8		16	9	13		10	18	14	
"	d	13	3	8		6	13	9		17	18	17	
Summary.													
British Isles	a	66	44	55		46	44	45		48	41	45	
"	b	25	36	31	86	38	34	36	81	29	37	33	78
"	c	4	13	8		9	11	10		9	11	10	
"	d	5	7	6		7	11	9		14	11	12	

Districts.		October 1883. Percentage. Wind.	Weather.	Average.	a+b.	November 1883. Percentage. Wind.	Weather.	Average.	a+b.	December 1883. Percentages. Wind.	Weather.	Average.	a+b.
Scotland, N.	a	42	42	42	80	44	67	56	81	37	70	54	82
"	b	36	30	33		30	20	25		40	17	28	
"	c	16	6	11		13	13	13		13	3	8	
"	d	6	13	9		13	0	6		10	10	10	
Scotland, E.	a	49	49	49	88	44	57	51	77	43	54	49	77
"	b	35	42	39		33	20	26		33	23	28	
"	c	16	6	11		10	13	12		17	7	12	
"	d	0	3	1		13	10	11		7	16	11	
England, N.E.	a	49	45	47	78	60	40	50	82	54	37	46	77
"	b	29	32	31		24	40	32		23	40	31	
"	c	19	16	17		3	17	10		20	13	17	
"	d	3	7	5		13	3	8		3	10	6	
England, E.	a	65	48	57	92	64	40	52	83	43	50	47	77
"	b	29	42	35		23	40	31		40	20	30	
"	c	6	3	5		10	13	12		10	23	16	
"	d	0	7	3		3	7	5		7	7	7	
Midland Cos.	a	58	58	58	89	50	50	50	82	50	60	55	82
"	b	36	26	31		37	27	32		33	20	27	
"	c	3	6	5		7	13	10		10	10	10	
"	d	3	10	6		6	10	8		7	10	8	
England, S.	a	71	65	68	93	50	57	54	82	53	47	50	82
"	b	26	23	25		33	23	28		37	27	32	
"	c	3	9	6		10	10	10		7	13	10	
"	d	0	3	1		7	10	8		3	13	8	
Scotland, W.	a	29	42	36	73	40	47	44	79	17	57	37	71
"	b	26	49	37		37	33	35		40	27	34	
"	c	29	3	16		17	7	12		27	10	18	
"	d	16	6	11		6	13	9		16	6	11	
England, N.W.	a	29	36	33	3	23	54	39	84	34	53	44	70
"	b	35	45	40		57	33	45		33	20	26	
"	c	26	13	19		13	13	13		20	10	15	
"	d	10	6	8		7	0	3		13	17	15	
England, S.W.	a	42	45	44	79	50	53	52	84	47	47	47	79
"	b	26	45	35		37	27	32		33	30	32	
"	c	26	7	17		10	13	11		17	10	13	
"	d	6	3	4		3	7	5		3	13	8	
Ireland, N.	a	32	45	39	76	44	54	49	82	40	67	54	77
"	b	39	35	37		33	33	33		33	13	23	
"	c	19	10	14		13	13	13		10	17	13	
"	d	10	10	10		10	0	5		17	3	10	
Ireland, S.	a	45	42	44	78	40	57	49	77	33	53	43	80
"	b	26	42	34		30	27	28		37	37	37	
"	c	10	13	11		17	10	14		13	7	10	
"	d	19	3	11		13	6	9		17	3	10	

Summary.

British Isles	a	46	47	47	81	46	53	50	81	41	54	48	78
"	b	31	38	34		34	29	31		35	25	30	
"	c	16	8	12		11	12	12		15	11	13	
"	d	7	7	7		9	6	7		9	10	9	

Districts.		January 1884. Percentages. Wind.	Weather.	Average.	a+b.	February 1884. Percentages. Wind.	Weather.	Average.	a+b.	March 1884. Percentages. Wind.	Weather.	Average.	a+b.
Scotland, N.	a	21	46	34		39	48	44		48	65	57	
"	b	42	42	42	76	36	33	34	78	39	23	31	88
"	c	25	4	14		21	15	18		13	3	8	
"	d	12	8	10		4	4	4		0	9	4	
Scotland, E.	a	38	38	38		38	36	37		68	58	63	
"	b	25	25	25	63	31	46	39	76	26	26	26	89
"	c	16	16	16		28	7	17		6	13	10	
"	d	21	21	21		3	11	7		0	3	1	
England, N.E.	a	43	47	45		48	42	45		55	43	49	
"	b	32	32	32	77	24	34	29	74	32	37	35	84
"	c	14	14	14		17	7	12		10	3	6	
"	d	11	7	9		11	17	14		3	17	10	
England, E.	a	46	46	46		24	38	31		50	40	45	
"	b	43	29	36	82	45	41	43	74	37	43	40	85
"	c	7	14	11		21	14	18		3	10	7	
"	d	4	11	7		10	7	8		10	7	8	
Midland Cos.	a	36	57	47		42	31	37		60	37	49	
"	b	54	36	45	92	31	45	38	75	23	40	31	77
"	c	7	4	5		24	3	13		7	17	12	
"	d	3	3	3		3	21	12		10	6	8	
England, S.	a	61	54	58		38	38	38		58	40	49	
"	b	32	32	32	90	38	41	40	78	23	37	30	79
"	c	0	7	3		17	14	15		10	20	15	
"	d	7	7	7		7	7	7		9	3	6	
Scotland, W.	a	21	50	36		25	36	31		42	54	48	
"	b	42	29	35	71	32	36	34	65	42	23	33	81
"	c	21	17	19		36	18	27		10	10	10	
"	d	16	4	10		7	10	8		6	13	9	
England, N.W.	a	26	30	28		36	36	36		57	53	55	
"	b	44	52	48	76	43	39	41	77	30	20	25	80
"	c	15	11	13		18	11	15		10	17	14	
"	d	15	7	11		3	14	8		3	10	6	
England, S.W.	a	32	36	34		48	48	48		54	52	53	
"	b	50	50	50	84	31	28	30	78	40	27	34	87
"	c	11	3	7		14	17	15		3	14	8	
"	d	7	11	9		7	7	7		3	7	5	
Ireland, N.	a	64	54	59		55	68	62		50	57	54	
"	b	14	36	25	84	35	11	23	85	32	32	32	85
"	c	11	7	9		3	7	5		11	11	11	
"	d	11	3	7		7	14	10		7	0	3	
Ireland, S.	a	43	50	47		45	61	53		50	57	54	
"	b	28	36	32	79	31	21	26	79	25	32	28	82
"	c	18	7	12		10	4	7		7	7	7	
"	d	11	7	9		14	14	14		18	4	11	

Summary.

British Isles	a	39	46	43		40	44	42		54	51	53	
"	b	37	36	36	79	34	34	34	76	32	31	31	84
"	c	13	10	12		19	11	15		8	11	10	
"	d	11	8	9		7	11	9		6	7	6	

APPENDIX XIII.

LIST of STATIONS from which DAILY SYNCHRONOUS OBSERVATIONS (at 0h. 8m. p.m. G. M. T.) have been received in 1883.

Stations.	Observers.	Remarks.
	ENGLAND AND WALES.	
Bolton - - -	Rev. T. Mackereth, F.R.A.S.	—
Bradford - -	J. McLandsborough, F.R.A.S., F.R. Met. Soc.	—
Cardington - -	J. McLaren, F.R. Met. Soc.	—
Chatham, School of Military Engineering.	G. A. Pickles, L.-Corp., R.E.	—
Falmouth Observatory -	The Staff.	—
Greenwich Observatory -	The Staff, for the Astronomer Royal.	—
Guernsey - -	A. Collenette, F.R. Met. Soc.	—
Kew Observatory -	The Staff.	—
Leicester (Museum) -	J. C. Smith.	—
Liverpool Observatory (Bidston).	J. Hartnup, Jun.	—
Oscott (St. Mary's Col.)	Rev. J. W. Browne.	—
Oxford, Radcliffe Obs. -	The Staff.	—
Plymouth - -	J. Merrifield, LL.D., F.R.A.S.	—
Sheffield - - -	W. F. Cooper.	—
Silloth - - -	Rev. F. Redford, M.A., F.R.S.E.	—
Stonyhurst Observatory -	The Staff.	—
Strathfield Turgiss -	Rev. C. H. Griffith, M.A., F.R. Met. Soc.	—
Truro (Royal Institution)	W. Newcombe.	—
	SCOTLAND.	
Aberdeen Observatory -	The Staff.	—
Glasgow Observatory -	The Staff.	—
Orkneys (Sandwick Manse).	Rev. C. Clouston, LL.D.	—
	IRELAND.	
Armagh Observatory -	Dr. J. L. E. Dreyer.	—
Galway, Queen's College	M. J. O'Donoghue.	—
Valencia Observatory -	The Staff.	—
	BRITISH COLONIES, POSSESSIONS, &c.	
Barbados, W. I. - -	Surgeon-Maj. in charge.	—
Gibraltar - -	Surgeon Gen. in charge.	—
Malta - - -	A. King.	—
Nassau (Bahamas) -	C. L. Dunscombe.	—
Natal - - -	Surgeon-Maj. in charge.	—
Scutari, British Cemetery	Serg. W. H. Lyne, R.E.	—
Sierra Leone - -	Surgeon-Maj. in charge.	—

SUMMARY.

—	—
England and Wales -	18
Scotland - - -	3
Ireland - - -	3
Colonies and British Possessions -	7
Total	31

APPENDIX XIV.

METHODS FOLLOWED IN DEALING WITH METEOROLOGICAL RETURNS FROM LAND STATIONS IN THE UNITED KINGDOM.

These stations are of five classes, as stated on page 19.

I.—*Observatories continuously observing all the Meteorological Elements.*

Returns from observatories.

Hourly measurements of the curves obtained from the self-recording instruments at the observatories of the Office are made by the observers at each station, on printed forms supplied for the purpose, which, together with the curves, are forwarded to the Office weekly. They comprise measurements of the barograms, of the dry and wet-bulb thermograms, of the anemograms, and of Beckley's rain-gauge curves.

Examination of returns.

The measurements are subjected to a careful examination in order to ensure as far as possible their accuracy, and the regulations which have been adopted to secure this end will be found fully detailed in the Report of the Office for 1868. They comprise rules for the guidance of observers, as well as of the assistants charged with the examination of the work at the Office. Attention need be called here to only two of these rules, viz.: (*a*) the use of subsidiary sheets on which are entered the results of a second set of measurements of the curves, made after, and quite independently of, the first set and with a different scale, the two sets of measures being afterwards compared together, and any differences found inquired into and set right; and (*b*) the re-measurements of the curve made by the assistants at the Meteorological Office, and which always amount to 40, and in doubtful cases to many more, per month for each element. The attention of the observers is always drawn to such errors as may be detected, and to any failures in the continuity of the curves arising from failure of the light, stoppage of the clock, defective photography, faulty action of the wet-bulb thermometer, &c.; a report containing the results of the examination of each Observatory being also submitted to the Council each month and printed in their minutes. The curves and tabulations are eventually bound and stored in the Office.

Results of examination and report to Council.

Chart plates.

In the more recent numbers of the Quarterly Weather Report (for 1876) plates of charts are issued showing the conditions of barometrical pressure and wind for Western Europe for 8 a.m. and 6 p.m. each day, each plate containing 36 charts.

General supervision of observatory work.

In connexion with this work should be mentioned the general watch which has to be kept over the working of the observatories and of the instruments, not only to secure uniformity amongst them and observance of rules, but also to guard against small changes which are liable to occur at certain times, especially with the thermographs, and which may affect the scale-values of the instrument or the datum lines used for the tabulation of the curves. About twice a year this work calls for special examination, entailing some considerable time and occasionally the engraving of new scales for measuring the curves.

Harmonic analyser.

The photographic curves are also used in the harmonic analyser; they require little or no preparation for this purpose beyond that necessary for their reduction for the Quarterly Weather Report.

METHOD OF DEALING WITH THE NUMERICAL RESULTS FROM THE SELF-RECORDING OBSERVATORIES.

Interpolations. In dealing with the tabulations the first step is to go over the sheets and fill up by interpolation, wherever possible, any gaps or breaks in the continuity of the record.

Means. The record having been made as complete as possible, the daily, five-daily, and monthly means of the barometer and of the dry-bulb and wet-bulb thermometers are obtained by addition.

Vapour tension. The hourly vapour tension is then computed by an expansion of Glaisher's Hygrometrical Tables, prepared in the Office, and the work independently checked.

Hourly Readings. A copy is next prepared of the above-mentioned hourly measurements of the barometer, dry-bulb and wet-bulb thermometers, wind and rain curves, and of the computed values of vapour tension. To these are added the daily means of the three first-mentioned elements, and the extremes and daily range of pressure and temperature, and the whole series is printed and published under the title of "Hourly Readings "from the Self-recording Instruments at the Seven Observatories "under the Meteorological Office."

To ensure accuracy the sheets are read over in proof with the originals. The interpolated readings are printed in *italic* type, but no distinguishing mark is affixed to the means which are partly based on them. When the gap in the record is too long to be dealt with by an interpolation of the missing hourly readings, the mean for the day is obtained by an interpolation from the adjacent daily means, and the result thus obtained is printed as an approximation.

Tables for the Quarterly Weather Report. The five-daily, monthly, and annual means, together with the absolute extremes of pressure and temperature for each month, have hitherto been published as an appendix to the Quarterly Weather Report, but in future, beginning with the volume for 1881, these values will be printed at the end of the "Hourly Readings." As before the tables will be repeated in French measures.

Gale tables. The gale tables printed in the text of the Quarterly Weather Report and of its successor, the Monthly Weather Report, which show the extent, duration, and degree of severity of all the stronger gales, are prepared from the tabulations of the anemograms received from the self-recording observatories, together with those received from the six extra anemographic stations.

II.—*Anemographic Stations at which the Wind is recorded continuously.*

The anemograms received from the six stations enumerated on page 87 are regularly examined and tabulated in the Office, and the sheets bound up in volumes. Besides special inquiries on legal and other points that from time to time arise, and in which these documents are of the highest importance, the tabulations are always employed in the preparation of the chronicle and gale tables for the Quarterly Weather Report. They are also regularly used in the checking of the storm warnings issued by the Office.

III.—*Method followed with regard to the Returns from Land Stations of the Second Order.*

Origin and progress of the system. Ever since the year 1866 returns of more or less completeness have been received from land stations in the United Kingdom. In that year there was only one station, but by 1871 the number had increased to

15, and five years later to 49, including 14 stations belonging to the Meteorological Society (London), copies of the returns from which were sent to the Office under a special arrangement with the Society.

At the end of the present year the total number of stations is 74, including 15 belonging to the Royal Meteorological Society and 5 belonging to the Scottish Meteorological Society.

This number is exclusive of the self-recording observatories, and of the anemographic stations, but it includes several from which only very scanty information is received.

The stations are distributed as follows: 42 in England, 4 in Wales, 12 in Scotland, and 16 in Ireland.

The returns are received at the Office monthly, and are duly entered and stored.

Publication on Form A.

The publication of the returns is carried out in the following way: For a certain number of stations the observations of pressure, temperature, wind, cloud amount, and weather at 9 a.m. and 9 p.m. each day, together with the computed vapour tension and relative humidity at those hours, and the daily maxima and minima of temperature, and daily rainfall, are published *in extenso* on the Form, A., proposed by the Permanent Committee of the First International Meteorological Congress at Vienna in 1874, and adopted for international use by the Second International Meteorological Congress at Rome in 1879.

The Permanent Committee assigned an inferior limit to the number of stations from which returns should be published *in extenso*, varying from two for Belgium to 100 for Russia in Asia, the number in the case of the United Kingdom being 15. In 1875, when the systematic publication of returns from Stations of the Second Order began, only nine British stations were available, but this number has steadily grown, until for 1880 returns from 33 stations are actually published on the A. Form, and the list could be at once increased, if thought desirable.

Additions to the list for publication.

Care is taken in adding to the list for publication to see, first, that the station is satisfactory as regards its instruments, their exposure, &c.; secondly, that the returns bear internal evidence of accuracy and care in their preparation; and thirdly, that the district represented by the station is one for which information is needed.

Examination the returns.

All the returns selected for publication on Form A. are carefully examined and compared before being copied for the printer. The reduction of all the barometer readings to 32° Faht. at mean sea level is checked, and the corrected readings are then compared with the isobars on the Daily Weather Charts and readings at neighbouring stations for the day, allowance being made for any difference in time and the corresponding change in barometric pressure.

The correction of the readings of the dry-bulb and damp-bulb thermometers is checked, and the maxima and minima temperatures are compared with the dry-bulb thermometer readings over the same periods to ensure that they are the extreme temperatures registered.

The computed values of the vapour tension and the relative humidity are examined from the tables. The cloud amount is compared with the weather at the time of observation, and finally, the sums and means are all re-calculated.

Doubtful readings.

If any readings are doubtful, reference is made through the observer to the original observation book. If no fresh light is thrown on the question by this means, and if on reconsideration the reading still appears to be wrong, it is rejected, and the probable reading is inserted in its place, but printed in different type as an interpolation. These probable readings are used in obtaining the monthly means. Similarly,

if from any cause a set of readings has been omitted, the gap is filled by an interpolation, and the probable values are printed in different type.

Apparent errors, or discrepancies, in the working on the sheet are also referred to the observer before alteration.

Unpunctual observations.

The observations are taken at 9 a.m. and 9 p.m. local time each day. It sometimes happens, however, that strict punctuality cannot be observed. In such cases, if the difference in time does not exceed 30 minutes, the observations are, in most cases, printed without alteration. When the difference exceeds 15 minutes, a note is inserted in the remarks showing the exact time of observation. If the difference in time is more than half-an-hour, the readings are usually rejected and an interpolation made.

Besides this publication in full, the monthly means of the various elements, together with summaries of the wind direction and of the weather, are published on the Form, B., also devised by the Permanent Committee of the Vienna Congress, and adopted by the Roman Congress.

Returns from six stations were published in this manner for the year 1873, and from nine stations for the year 1874. In 1875 the list included the names of 26 stations. This number has grown to 43 for the year 1880, and might be even further increased.

All the stations, returns from which are published *in extenso* on Form A., are included in the Form B. list. But this list also includes others, either not quite so good, not so representative, or not so long established. The method of preparation is in the main the same as in the case of the Form A. But the summaries of wind and weather are specially prepared for this publication. For wind, the summary shows the number of *observations* at 9 a.m. and 9 p.m. under each of the bi-quadrantal points N., N.E., E., &c., the observations under intermediate points being thrown alternately forward and backward. For weather, the summary gives the number of *days* of rain, snow, hail, thunderstorm, clear sky, overcast, and gale. The days of clear sky and overcast are those when the mean of the cloud amounts at 9 a.m. and 9 p.m. are less than 2, and more than 8 respectively. The days of gale are those when force 7 or upwards, by Beaufort scale, is recorded.

New stations.

When an application for the adoption of a new station is received, a schedule is forwarded to the observer containing a series of questions at to the outfit of the station, the exposure of the instruments, and the influence likely to be exerted on their indications by surrounding objects, such as houses and trees. Only mercurial barometers are accepted, and only such as have been duly verified. All thermometers must have been tested at Kew. A plan of the station, showing the positions of the instruments with regard to neighbouring objects is also required.

On the return of this schedule the answers are considered, and, where necessary, alterations are advised.

If, however, the existing arrangements are satisfactory, tables for reducing the barometer readings to 32° Fahrenheit at mean sea level are prepared and duplicates sent to the observer, together with a set of Hygrometrical Tables, and a copy of "Instructions in the Use of Meteorological Instruments."

The first returns are compared and examined with special care, and a report of the result of the examination is forwarded to the observer, with instructions how best to complete and perfect the returns.

Sunshine records.

The daily records of sunshine which are now received from 29 Stations in the British Islands are examined generally to guard against accidental changes in the adjustment of the instrument. After their receipt has been acknowledged, the cards are duly stamped and dated and then stored in the Office.

A tabulation of these curves is published as part of the Weekly Weather Report, mentioned in Appendix VIII.

The curves for 1881 have themselves been engraved and published.

Inspection. The Stations of the Second Order are annually inspected, the attention of the inspector being directed by the Office to any special point which may require elucidation.

IV.—*Telegraphic Reporting Stations.*

Full particulars relating to these stations, the information received from them, and the method of dealing with that information, will be found in Appendix VIII. A paragraph in that Appendix (p. 64) explains the use that is made of the monthly schedules sent in by the observers.

V.—*Extra Stations.*

No returns from Stations of the Fifth Class are published by the Office, but some of them are regularly used in the checking of the storm-warnings, and all are available for any special investigation that may be taken up.

The rainfall values at these stations are, however, copied and supplied to Mr. Symons, F.R.S., for publication in "British Rainfall."

APPENDIX XV.

List of Documents relating to the Land Meteorology of the British Islands, received during the Year ending March 31st, 1884.

Stations.	Observers.	Nature of Information received.	Notes.
I. †Valencia	J. E. Cullum	-	Stopped at end of 1883.
†Armagh	S. Call, for J. L. E. Dreyer, Ph.D., F.R.A.S.	-	" " "
†Glasgow	Prof. R. Grant, LL.D., F.R.S.	Continuous records of pressure, temperature, wind, sunshine, and rain, with notes on the weather.	
†Aberdeen	Prof. C. Niven, M.A., F.R.S.		
†Falmouth	E. Kitto		
†Stonyhurst	Rev. S. J. Perry, F.R.S.		
†Kew	G. M. Whipple, B.Sc., F.R.A.S.		
II. Armagh	J. L. E. Dreyer, Ph.D., F.R.A.S.	Continuous record of wind and rainfall	From January 1884.
†Alnwick Castle	Major F. Holland, for the Duke of Northumberland, K.G.	Continuous record of wind (direction and velocity).	
†Holyhead	Hugh Williams, C.E.	" "	
†Sandwick	Rev. C. Clouston, LL.D.	" "	
Seaham	G. H. Aird	" "	
†Scilly	W. Thomas	" "	
†Yarmouth	G. T. Watson	" "	
Waterford	The Harbour Authorities	Continuous record of pressure.	
III. †Armagh	J. L. E. Dreyer, Ph.D., F.R.A.S.	-	From January 1884.
Aysgarth	Rev. Fenwick W. Stow, M.A., F.R. Met. Soc.	Regular observations at 9 a.m. and 9 p.m. of pressure, temperature, wind, cloud and weather, with the daily maxima and minima of temperature, and rainfall, and remarks on the weather generally.	
Babbacombe	E. E. Glyde, F.R. Met. Soc.		
†Braemar	James Aitken, Esq.		
Buxton	E. J. Sykes, M.B., F.R.A.S., F.R. Met. Soc.		
Carmarthen	G. J. Hearder, M.D.		
Chatham	Col. Sir C. Warren, R.E., C.B., K.C.M.G.		
Cheadle	J. C. Philips, F.R. Met. Soc.		
Cheltenham	R. Tyrer, B.A., F.R. Met. Soc.		
Churchstoke	Philip Wright, F.C.S., F.R. Met. Soc.		
†Cirencester	R. Gorton		

LIST OF DOCUMENTS—*continued.*

Stations.	Observers.	Nature of Information received.	Notes.
†Colebrooke	W. Ferguson, for Sir Victor Brooke, Bt., F.L.S.	Regular observations at 9 a.m. and 9 p.m. of pressure, temperature, wind, cloud and weather, with the daily maxima and minima of temperature, and rainfall, and remarks on the weather generally.	From January 1884.
†Douglas, Isle of Man	A. W. Moore, F.R. Met. Soc.		
†Dublin (Botanic Gardens, Glasnevin).	F. W. Moore		
†Dublin (City)	J. W. Moore, M.D., F.R. Met. Soc.		
†Dublin (Phœnix Park)	Col. R. H. Stotherd, R.E.		
S†Dundee	W. Ross McKelvie		
S†Dunrobin Castle	D. Melville		
Durham	G. A. Goldney		
Geldeston (Suffolk)	E. T. Dowson, F.R. Met. Soc.		
Glenalmond	W. Bezant Lowe, M.A.		
M Hillington	Rev. H. Ffolkes, M.A., F.R. Met. Soc.		
†Inverness	James Ferguson		
†Jersey (St. Aubin's)	J. E. Vibert, M.A.		
M Killarney	Rev. G. R. Wynne, F.R. Met. Soc.		
†Laudale (Argyleshire)	A. Fletcher, for T. H. G. Newton, M.A., F.R. Met. Soc.		
M Llandudno	J. Nicol, M.D., F.R. Met. Soc.		
Leicester	J. C. Smith, for Museum Authorities		
†Londonderry	J. Conroy, F.R. Met. Soc.		
M Margate	J. Stokes, F.R. Met. Soc.		
†Markree Castle, Sligo	E. Salles, and A. Marth, F.R.A.S., for Col. Cooper F.R.A.S.		
M Marlborough	Rev. T. A. Preston, M.A., F.R. Met. Soc.		
Newton Reigny (Penrith).	T. G. Benn, F.R. Met. Soc.		
†Oscott	Revs. J. W. Browne and J. O'Hanlon		
†Parsonstown	George Phillips, for the Earl of Rosse, F.R.S.		
†Peel, Isle of Man	T. H. Davis, F.R. Met. Soc.		

LIST OF DOCUMENTS—*continued.*

Stations.	Observers.	Nature of Information received.	Notes.
⚓† Pinmore - -	Peter Donald, Esq. - - - -	Regular observations at 9 a.m. and 9 p.m. of pressure, temperature, wind, cloud and weather, with the daily maxima and minima of temperature, and rainfall, and remarks on weather generally.	
Prestwich - -	T. R. H. Clunn, M.D. - - - -		
⚓† Rothesay - -	James Kay, Esq. - - - -		
† Sandwick - -	Rev. C. Clouston, LL.D. - - -		
Scaleby - -	R. A. Allison, F.R. Met. Soc. - - -		
Scarborough - -	F. Shaw, F.R. Met. Soc. - - -		
Seaham - -	G. H. Aird - - - - -		
† Southampton -	J. T. Cook, R.E., for Director General of Ordnance Survey.		
Stokesay - -	Miss M. A. Digges La Touche - -		
† Stonyhurst - -	Rev. S. J. Perry, F.R.S. - - -	- - - - -	From July 1883.
Strathfield Turgiss -	Rev. C. H. Griffith, B.D., F.R. Met. Soc. -		
† St. David's, Pembroke	W. P. Propert, LL.D., F.G.S., F.R. Met. Soc.		
† St. Leonards - -	H. Colborne, M.R.C.S. - - -		
† Totnes - -	T. H. Edmunds - - - -		
Uppingham - -	Rev. G. H. Mullins, M.A., F.R. Met. Soc. -		
Wakefield - -	H. Clarke, L.R.C.P., F.S.S., F.R. Met. Soc. -		
† York - - -	W. Keeping, M.A., F.G.S., and H. Platnauer -		
IV. The Telegraphic Stations, see List on p. - - - -		Regular observations twice (and in some cases three times) daily of pressure, temperature wind, weather, and sea disturbance.	
V. Baltimore - -	J. Halsey - - - - -	Full return, except for temperatures of dry and wet bulbs.	From July 1883.
Castletownsend -	Lieut. T. W. Cobb, R.N. - - -	Pressure and temp. four times daily, and wind twice daily.	
Crookhaven - -	,, ,, - - -		
Crosshaven - -	J. W. Bridle - - - -	Pressure, temperature, and wind, twice dally.	
Cooper's Hill (Egham)	Prof. H. McLeod, F.R.S. - - -	Full return for 9 a.m. and 3 p.m.	
Ennis - -	J. Hill, C.E., F.R. Met. Soc. - - -	Daily rainfall.	
Gorleston, Norfolk -	R. C. J. Day - - - - -	Pressure and wind twice daily.	

LIST OF DOCUMENTS—*continued.*

Stations.	Observers.	Nature of Information received.	Notes.
Harpenden - -	T. Wilson, F.R. Met. Soc. - - -	Pressure, temperature, and wind, twice daily, with rainfall.	
Haslar - -	G. Coppen - - - - -	Pressure and temperature four times daily.	
†Helston - -	J. Gill - - - - - -	Full return, except for barometer.	
Limerick - -	Capt. C. M. Wilson - - - -	Pressure and temperature twice daily -	Register incomplete.
Llandovery - -	J. Watkins, F.R. Met. Soc. - - -	Daily rainfall.	
Rugby - -	C. H. Hodges, M.A. - - - -	Full 9 a.m. obs. with 9 p.m. temperatures.	
Saffron Walden -	J. G. Bellingham - - - -	Pressure and temperature twice daily, with a.m. wind and rainfall.	
Sandend (Banffshire)	James McKay - - - -	Pressure, wind, and weather once daily.	
Schull - -	Lieut. T. W. Cobb, R.N. - - -	Pressure, temperature, and wind twice daily.	
Sheffield - -	W. F. Cooper - - - -	Full returns for 8 a.m. and 11 p.m.	
Sheffield (Weston Park)	Elijah Howarth - - - -	Pressure, temperature, and wind, twice daily.	
Symbester, Shetland -	J. Bruce, Esq. - - - -	Pressure and temperature twice daily -	Register incomplete.
Tarbert (Harris) -	Donald Bethune, for Sir E. Scott, Bt. - -	Full returns for 9 a.m. and 6 p.m.	
Union Hall - -	Lieut. T. W. Cobb, R.N. - - -	Pressure, temperature, and wind, twice daily.	

NOTE.—The Stations marked "𝔐" belong to the Royal Meteorological Society; those marked "𝔖" belong to the Scottish Meteorological Society; those marked thus † have been inspected during the year.

APPENDIX XVI.

Extract from the Minutes of the Meteorological Council, November 14, 1883.

MINUTE EXPLANATORY OF THE REASONS FOR WHICH THE METEOROLOGICAL COUNCIL HAVE RESOLVED TO CLOSE SOME OF THEIR SELF-RECORDING OBSERVATORIES.

The Meteorological Council, having given notice in February last of their resolution to discontinue four of the seven photographic self-recording observatories which had hitherto been maintained by them, namely, those at Falmouth, Armagh, Stonyhurst, and Glasgow, have received representations from the Royal Cornwall Polytechnic Society, which is interested in the Falmouth Observatory, and from several gentlemen who are interested in the Armagh Observatory, as well as from a Sub-Committee of Section A. of the British Association for the Advancement of Science, composed of persons eminent for their knowledge of physics or meteorology, stating their reasons for thinking it important that the observatories which it had been determined to close should be retained in operation, and requesting the Council to reconsider their resolution.

The Council, recognising the weight of the authority which has thus questioned their action on scientific grounds, have given to these representations the respectful consideration which is due to them, and having carefully reviewed their proceedings in this matter, they now purpose to record the reasons which led them to adopt the resolution the propriety of which has been questioned, and which, after a careful reconsideration of the subject, confirm them in maintaining the course they before resolved to follow.

The seven continuously self-recording observatories were established about 15 years ago, and have been in regular operation since the beginning of 1869. The Meteorological Council, which body succeeded the old Meteorological Committee in 1877, was constituted on the Report of a Treasury Committee, which must be regarded as defining generally the scope of the operations of the Council, and the objects to which the public funds granted by Parliament and placed under their control should be applied.

It became one of the first duties of the Council to review the system under which the work of the Meteorological Office was carried on, and among the questions which thus came under consideration was that of the extent to which the funds at the disposal of the Council should continue to be applied to the maintenance of the self-recording observatories, the direct cost of which was very considerable, besides requiring a large share of the time of the Office in the preparation of the observations for publication, which in itself also was a serious cause of further expense.

The necessity for this reconsideration had indeed been indicated in the Report of the Treasury Committee, which, referring to the self-recording observatories, remarked as follows:—"It may deserve con-"sideration by the Council whether some, at any rate, of the existing "stations may not be discontinued, and others obtained in more eligible "sites. Doubts have also been expressed whether, in the present state

" of meteorological science, the minute exactness of the observations " now taken at these stations is of sufficient comparative value to " justify the whole of the costs which they involve, when there are " so many other objects of meteorological inquiry which call for " increased expenditure."

To show the serious practical importance of this question in its financial aspect, it will suffice to state that the costs of these observatories since their opening in 1867 till April 1882, including the charges for the reduction of the observations, and their preparation for publication, so far as this has been carried out, had amounted to no less than 52,782*l.*, besides the cost of publication and printing. Moreover, as the instruments have now been in use for so long a time, some of them require renewal, which will entail a considerable outlay.

Under the continually increasing pressure to add to the efficiency of other branches of the work of the Office, the Council was led to discuss from time to time the question of how best to deal with these observatories, and the decision first come to was that no change should be made at all events until the full cycle of 11 years had been completed. Early in 1882 the Council considered that the time had arrived when a final decision could no longer be properly delayed, and, subject to the result of further inquiries which they desired to make of eminent foreign meteorologists, they came to the conclusion that the retention of the whole number of seven self-recording observatories need not be continued after the end of 1883, which somewhat distant date was named to admit of reasonable notice being given to the observatories which might be discontinued.

The opinions specially asked for were those of Dr. Hann, the director of the Vienna Meteorological Observatory, of Dr. Wild, the head of the Meteorological Service in Russia, and of Mr. H. S. Eaton, a past President of the Meteorological Society of London. The well-known eminence of the two former gentlemen and their long practical experience as directors of large meteorological systems of observation, as well as their obvious freedom from all possible local prejudice, induced the Council to select them and to attach great weight to their opinions, which are therefore annexed *in extenso*. The opinion of the other gentleman consulted was quite to the same effect.

The late Chairman of the Council, Professor H. Smith, on the 16th May 1882, addressed the following letter of inquiry to the persons thus consulted :—

" As you are no doubt aware, a system of seven self-recording observatories has been now maintained by the Meteorological Office for more than 14 years; and the opinion has been expressed by some meteorologists of eminence that the time has arrived when this system should be revised, with a view to a considerable diminution in the number of the observatories.

" I venture to ask you as a great favour, to communicate to me any opinion which you may be led to form as to the question thus raised.

" The funds annually placed at the disposal of the Meteorological Council by Her Majesty's Government are strictly limited in amount; on the other hand, the Council is allowed considerable latitude in the appropriation of their annual grant.

" Under these circumstances the question of the continued maintenance of the observatories presents itself to the Council, as turning, not on the desirability in itself of the continuance of the present system, but on the importance of that object as compared with other branches of meteorological work.

"If any of the observatories were suppressed, the funds thus liberated would not be lost to meteorology, but would be applied to other purposes of recognised importance, such as—

"(1.) The more complete discussion of the continuous records already obtained;

"(2.) Extensions of the existing arrangements for the synoptic study of weather;

"(3.) Experimental researches on the physical problems of meteorology; or

"(4.) The more complete equipment of such of the observatories as might be retained.

"And it is felt by the Council that the cost of the seven observatories encroaches perhaps unduly on the funds which would be available for these or similar purposes.

"It has been suggested that the number of observatories might be reduced to three; one at Kew, one at Valencia, one at Aberdeen, or some place in the north of Scotland; these three points forming a nearly equilateral triangle which covers a great part of the United Kingdom.

"I shall be greatly obliged to you if you could inform me whether, in your opinion, three self-recording observatories, supported of course by stations of the second order, would be sufficient to furnish an adequate continuous record of the climate of the British Isles; and if you should think the number three insufficient, whether any smaller number than seven would, in your judgment, suffice."

Dr. Hann wrote in reply as follows:—

"I think that three observatories of the first order, Valencia, Kew, and a third in the north of Scotland, ought to suffice for permanent service. The materials which have already accumulated from the seven observatories should certainly suffice for the investigation of the daily march of the principal elements of meteorology.

"If I were in the place of the Meteorological Council and had to decide this point, I should certainly, in view of the great expense of seven observatories, preserve only three, one in each kingdom, and abolish four of them, as soon as they had yielded material enough to solve the problems of local climatology.

"I should, however, maintain these points as stations of the second order, for observations to be made two or three times daily, if there do not exist in their vicinity stations of that class in similar situations.

"Eventually, if funds were readily available, I should erect at each of the seven observatories simple mechanical barographs (Höttinger's or Kreil's, at a cost of about 20*l.*), in order to trace the progress of barometrical waves in special cases, and should also leave the anemometers in action. I should not, however, reduce the records fully, but simply use them to trace easily the history of storms and squalls, in short to facilitate the study of extraordinary atmospherical phenomena.

"The apparatus mentioned does not require further attention than the insertion of, and the dating of, the papers, so that the cost of maintenance could not be high.

"I should not continue the records of temperature or humidity, but should possibly keep up that of rain, if that is mechanical and does not involve much expense or trouble.

"I am at present gradually establishing at various points in the Austrian Empire the very simple barographs of Höttinger (Zürich) which are very convenient, and not only enable us to trace the progress

of barometrical minima, but lead to the easy detection of errors in reading the mercurial barometer at the regular hours of observation.

"I fully approve of the proposal that the funds set free by the suppression of four of the observatories should be primarily devoted to the complete discussion and reduction of the material already accumulated from the entire seven, and secondarily to meteorological investigations of the modern type (*zeitgemäss*) and with a different object, such as synoptic studies [with the help of mean values for long periods, on the basis of monthly means] embracing large areas of the earth's surface —problems of physical meteorology—the establishment of stations of the second order at points where they would be desirable for synoptic work or for the investigation of special local peculiarities of climate."

Dr. Wild said :—

"The question of the possible reduction of the number of the automatic observatories in the British Isles is in its nature of such importance to the science of meteorology in general, that I have felt much difficulty in answering it.

"It would of course be in itself desirable for the investigation of the climate of a country to maintain as many stations in it provided with self-recording instruments as is possible. Unfortunately, however, the funds available for meteorological inquiry are, in almost all cases, so limited that they will only suffice to meet a certain proportion of the demands made on them. Under these circumstances, therefore, we must from time to time devote our energies to such inquiries and discussions as appear the most urgent and important for the progress of the science at the time.

"If from this point of view we consider the number of automatic observatories whose maintenance in a country is necessary, we shall certainly be led to recommend that this number should be limited in comparison with what may be deemed desirable.

"Almost without exception, the only scientific use which has been made of these frequent or continuous observations has been to deduce the diurnal range of each element, and thence to determine the corrections applicable to the observations taken at regular intervals, in order to obtain true daily means. Nay more, in view of the very small number of such stations in most countries it would be impossible to utilize their observations in any other direction.

"The disproportionate expense which the maintenance of such stations involves appears to me, in consideration of the impossibility of discussing their results in all directions, to indicate the necessity of reducing their number to such an extent as to render it possible to carry out the speedy and complete discussion of their records in the way above indicated.

"As to the United Kingdom in particular, I am of opinion that, as the seven observatories have been at work for 14 years, they have yielded material sufficient to exhibit the diurnal range of the principal elements for all parts of the British Isles, and that the time has come for reducing them to about three, so as to set free funds for the discussion of the records collected, and for the treatment of other important subjects in our science. Three such observatories in your country ought to be enough to enable you to trace extraordinary phenomena in the same detail as is done elsewhere, and to complete the materials for the study of diurnal range."

After the receipt of these opinions the Council, before finally settling which of the stations, if any, should be given up and which should be retained, had many administrative points to consider. The retention of Kew was essential in connexion with the necessary provision of the

means of verifying and testing new instruments and methods of observation. Valencia, though the most costly, is also obviously the most important of the stations, in respect of all questions relating to the study and forecasting of the weather. Aberdeen, occupying a position nearly at the apex of an equilateral triangle of which Kew and Valencia formed the base, appeared to be the best practicable locality for a station in the north of the British Isles, a preference which was sustained by its position on the east coast, well exposed to the north. Some hesitation was felt as to Falmouth on account of its undeniably good geographical position; but the confined site of the observatory was held to be so unfavourable for the correct record of the temperature, humidity, and wind of the adjacent district, as to lead the Council to think that it should not have a place among the observatories to be retained in their present complete and costly form. With reference to this last point, on which the Inspectors of the Office have always insisted, the evidence of Dr. Mann (then recently President of the Meteorological Society) before the Treasury Committee may further be cited. He said:—"At Fal-
" mouth the observatory stands upon an accidentally selected spot,
" where a small street occupies the uniting line between two high
" ridges in a *cul de sac*. The temperature observations taken there are
" not comparable, certainly with those of observatories that are more
" fairly placed."

" . . . . (*Chairman.*) Do I understand you that the observatory at
" Falmouth is so placed as to be under very peculiar meteorological
" conditions?—Yes, under local conditions which do not give good
" general results."*

The Meteorological Council never had any doubt of the general importance of maintaining continuous records of the meteorological elements at several stations in the British Isles, and on this point they are quite in accord with the Sub-Committee of the British Association. The difference of opinion which exists arises from a different estimate of the relative importance of the various branches of the duties which have to be discharged by the Council, and of what will be the most effective distribution of the grant placed at its disposal, which, though on a liberal scale, is yet limited in amount, and an increase to which they could not suggest with any prospect of success without far stronger reasons than, in their opinion, could be based on the scientific urgency of maintenance of the observatories in question.

The Council, being thus constrained to regard the matter at issue as one which must be looked at in its financial, no less than in its scientific bearing, cannot avoid the conclusion that those who have so strongly urged the continued maintenance of the seven self-recording observatories have no adequate knowledge of the very large area over which the operations of the Meteorological Office extend, of the many subjects to which attention has to be given in the study of the meteorology not only of the land but also of the sea, and of the multiplied and increasing demands made upon it in other directions than those that have been pressed upon it in the memorials now under consideration. The objections made to the decision of the Council are not accompanied by any reference to these other demands which cannot at present be met for want of funds, nor have these been weighed one with another, neither does it seem to have been considered whether much at least of what is

* Report of the Treasury Committee appointed to inquire into the conditions and mode of administration of the annual grant in aid of meteorological observations [C.—1638.], 1877, page 88.

desired might not be secured as well and more economically under a modified system.

It is the belief of the Council that all that is really required in the interests of science can be obtained under the arrangements they have in view, and which they propose to carry out when the funds set free by the reduction in the number of observatories are available.

So far as the ordinary meteorological constants for the seven observatories are concerned, the Council feel confident that these may be obtained with all the accuracy required for present scientific needs from the records already accumulated and published or in course of publication, extending over not less than 13 years. They also consider that the maintenance of the observatories which they have decided to retain, viewed in connexion with the records of other similar institutions in this and other countries, will give ample means of studying any periodical variation of long period, such as the 19 years cycle which has been specially alluded to; although it is certain, from discussions which have already been undertaken, that such variations must be extremely small, so that it is doubtful whether their existence can be established, and difficult to believe that they would be found to be of any practical importance either in respect to climate or changes of weather,—the two branches of meteorology with which the public is most concerned.

It remains for the Council to explain the arrangements which they design to carry out, as soon and as far as practicable, as funds become available, with a view to removing recognised deficiencies in their present arrangements. These will chiefly consist in an increase in the number of the telegraphic reporting stations with an improvement in their equipment, and additions to the staff of the Office, in the following manner:—

1. By supplying many of the stations with inexpensive continuously recording mechanical barographs, to be employed as differential instruments, controlled by frequent readings of the ordinary mercurial barometer. These would be fully adequate to show the passage of barometric fluctuations, and of ensuring that no sudden event should pass unnoticed, while the progressive changes of pressure they indicated could be communicated by telegraph by aid of a special code of signals. A similar system of recording temperature could be extended to some selected stations.

2. By establishing self-recording anemometers in properly exposed situations, possibly connected electrically with the telegraph stations, which being usually in towns and sheltered from winds, are generally ill-suited for observations of wind direction and force.

3. By making arrangements for more systematic observations at or near telegraphic stations, of the upper aërial currents, as indicated by the movements of clouds, and especially cirrus.

4. By establishing, when funds become available, a night service at the Office, by which forecasts of weather based on observations made as late as 11 p.m. might be issued in time for publication in the newspapers in London and principal towns in the country. The morning forecasts are now based on observations made at 6 p.m. of the previous evening, and 14 hours out of the 24 to which they relate have therefore elapsed before they can be read.

5. By providing additional scientific staff in the Office, the time of its present establishment being absorbed by routine duties. A more thorough and continuous watch over the system of forecasts and the actual weather ensuing is requisite, as well as increased attention to the

early discussion of the observations, and closer supervision of the experiments and trials of new instruments.

By these measures, which will greatly increase the number of self-recording stations, it is believed that most of the objects held to be important by meteorologists will be better met than by the necessarily limited operation of the self-recording observatories which would be given up, whose efficacy in assisting the preparation of forecasts of weather is extremely small. The superior accuracy of the observations made at the existing observatories hardly extends beyond those of the dry and wet bulb thermometers, and the proposed greatly increased number of the stations at which continuous observations of pressure and wind would be recorded would more than compensate for such advantages as might otherwise be lost by the change.

The Council have no hesitation, on this review of their position, in recording their opinion that the objects which they have thus enumerated will, to say the least of it, require all the funds that can be saved by a reduction in the number of the observatories, and that these objects are of a nature to claim precedence over the continued register of the barometer and wet and dry bulb thermometers on the refined and costly system of the photographic self-recording observatories.

In conclusion, the Council would express their hope that local efforts may, in some cases at least, be forthcoming to maintain the observatories which they cannot, consistently with other demands on them, continue to support, and they are prepared to make moderate grants for a limited time for these observatories, to continue them in operation until such arrangements could be matured, and to place the instruments at the disposal of the body which undertakes to make use of them. As regards Falmouth, it would be the wish of the Council to secure a first-class self-recording observatory there or in the neighbourhood, provided that a thoroughly satisfactory site could be obtained, and if the cost of maintenance was not too great. Failing this, they would, as already stated to the Royal Cornwall Polytechnic Society, co-operate in the maintenance of a second-class observatory at the Land's End in connexion with the telegraph station, and they will now be prepared to co-operate in maintaining the barograph alone at the present station at Falmouth.

APPENDIX XVII.

ACCESSIONS TO THE LIBRARY DURING THE YEAR ENDING 31ST MARCH 1884.

A—AGRICULTURE AND BOTANY.

* **Baker, T. H.** — Records of the seasons, prices of agricultural produce, and phenomena observed in the British Isles. vii. + 360 pp. sm. 8°. London, [1883].

Donop, L. B. [? S.] von.—Report on the agricultural prospects of British North Borneo. 34 pp., 1 plate, 4°. s.l.e.a.

Contains some rainfall and temperature observations.

‖ **Gibb, C.**—Report on Russian fruits. 55 pp. 8°. Montreal, 1883. (*From Eighth Rep. Montreal Hortic. Soc.*)

* **Hall, T. B.**—A flora of Liverpool, by T. B. Hall, with an engraved map; and an appendix, containing meteorological tables and observations for the year 1838, by **W. Armistead.** xvii. + 186 pp., 3 plates, 1 map, sm. 8°. London, s.a.

(Office of the Chief Signal Officer, Washington.)—Signal Service tables of rainfall and temperature compared with crop production. Prepared under the direction of **W. B. Hazen,** by **H. H. C. Dunwoody.** Professional Papers of the Signal Service. No. x. 15 pp. la. 4°. Washington, 1882.

Ufficio centrale di Meteorologia, Roma. — Rivista Meteorico-Agraria. Anno IV., 1883, Nos. 1–36. la. 8°. (Roma, 1883–84.)

This is a continuation of "Servizio Meteorico-Agrario."

B—ASTRONOMY.

Committee on Solar Physics, London.—Report by the Committee on solar physics appointed by the Lords of the Committee of Council on Education. iii. + 241 pp., 2 plates, 8°. London, 1882.

K. K. Sternwarte zu Prag.—Astronomische, magnetische und meteorologische Beobachtungen an der k. k. Sternwarte zu Prag im Jahre 1882. Auf öffentliche Kosten herausgegeben von **G. Gruss.** 43 Jahrg. xviii. + 62 pp. la. 4°. Prag, s.a.

Langley, S. P.—The selective absorption of solar energy. 28 pp., 3 plates, 8°. (*Amer. Journ. Sc., 3rd series,* xxv., 1883, *p.* 169.)

‖ **Montigny, C.**—Influence des perturbations magnétiques sur la scintillation des étoiles. 31 pp. 8°. Bruxelles, 1883. (*Bull. Acad. roy. de Belgique.* 3me *série, tome* vi., *No.* 11, 1883.)

‖ ———.—Notice sur la scintillation des étoiles dans ses rapports avec la constitution de leur lumière, d'après l'analyse spectrale. 23 pp. 8°. Bruxelles, 1883. (*Bull Acad. roy. de Belgique,* 3me *série, tome* vi., *No.* 12, 1883.)

Observatorio meteorológico-magnético central, Mexico.—Datos pluviométricos y agrícolas, relativos a la estacion de Aguas en el corriente año de 1883. la. f°. Sheet.

* **Oliver, J. A. W.**—Sunspottery: or, what do we owe to the sun? A popular examination of the cycle theory of the weather, famines, pestilencies, commercial panics, &c. 56 pp. sm. 8°. London, 1883.

Royal Astronomical Society, London. — Memoirs. Vol. xlvii., 1882–83. iv. + 463 pp., 5 plates, 4°. London, 1883.

———.—Monthly Notices . . . containing Papers, Abstracts of Papers, and Reports of the proceedings of the Society from November 1882 to November 1883. Vol. xliii., with plates, 8°. London, 1883.

NOTE.—Books marked * have been acquired by purchase; the others are donations from institutions, societies, or authors. Those marked ‖ are excerpt papers, extra copies of which have been separately printed.

In some cases additional publications have been received besides those specified, but only completed volumes or years are given here.

Royal Observatory, Greenwich.—Report of the Astronomer Royal to the Board of Visitors of the Royal Observatory, Greenwich, read at the annual visitation of the Royal Observatory, 1883, June 2. (By **W. H. M. Christie.**) 19 pp. la. 4°. s.l.e.a.

* **Swinton, A. H.**—An almanack of the Christian Era. Containing a legitimate prediction of the weather, disasters by wind and rain, shipwrecks and river floods, prognostics of the harvest, havoc by vermin and infection, famines and panics, electrical disturbances, calamities by earthquakes and volcanic eruptions, with much that is important or curious. A record of the past and glimpse into the future based on solar physics. 103 pp. 4°. London, 1883.

Venturi, A.—Metodo di Hansen per calcolare le perturbazioni dei piccoli pianeti intieramente rifuso ed originalmente esposto. 120 pp. sm. f°. Milano, 1882. (*Pubbl. R. Osserv. di Brera., N.* xxii.)

C—ATMOSPHERIC PRESSURE.

‖ **Busin, P.**—Misura delle altezze mediante il barometro. Letta nella seduta del 17 giugno 1883. 2 pp. 4°. (*R. Accad. dei Lincei*, vii°, *serie* 3ª.)

‖ ———.—Sui tipi isobarici italiani. Letta nella seduta del 17 giugno 1883. 4 pp. 4°. (*R. Accad. dei Lincei*, vii°, *serie* 3ª.)

‖ **Capello, J. C. De B.**—Barometrical depressions between the Azores and the Continent of Europe. 3 pp. la. 8°. (*Quart. Journ. Meteor. Soc.*, ix., 1883, *p.* 115.)

‖ **Gilbert, G. K.**—A new method of measuring heights by means of the barometer. 166 + 4 pp., 1 plate, sm. f°. Washington, 1882. (*Ann. Rep. U. S. Geol. Survey*, 1880–81, *p.* 405.)

‖ **Heath, D. D.**—On Mr. Ferrel's theory of atmospheric currents. 11 pp. 8°. (*Phil. Mag., July*, 1883, *p.* 13.)

‖ **Hildebrandsson, H. H.**—Sur la distribution des éléments météorologiques autour des minima et des maxima barométriques. (Présenté à la Soc. R. des Sciences d'Upsal le 10 Mars 1883.) 31 pp. 4°. Upsal, 1883. (*Nova Acta Reg. Soc. Sc. Ups., Ser.* iii.)

Scott, R. H.—Die "Krakatoa" Luftwelle. Notiz über eine Reihe barometrischer Störungen, August 27–31, 1883. Im Auszuge aus den Proceedings der Royal Society. 8 pp., 1 plate, la. 8°. (*Zeitschr. oesterr. Gesellsch. Meteor., Wien*, xix., 1884, *p.* 97.)

D—AURORA.

‖ **Lemström, S.**—Expériences sur l'aurore boréale en Laponie. 20 pp. la. 8°. (St. Petersburg, 1883.) [*Mittheil. internat. Polar-Comm. Viertes Heft, p.* 125.]

E—BIBLIOGRAPHY.

New York State Library.—Sixty-fourth and sixty-fifth annual reports of the Trustees . . . for the years 1881, 1882. 2 vols. 8°. Albany, 1882–83.

* **Royal Society, London.**—Catalogue of the scientific books in the library of the Royal Society. General catalogue. 1199 pp. 8°. London, 1883.

F—CLIMATE AND HYGIENE.

* **Bryson, A.**—Report on the climate and principal diseases of the African station; compiled from documents in the Office of the Director-General of the Medical Department, and from other sources, in compliance with the directions of the Right Honorable the Lords Commissioners of the Admiralty, under the immediate direction of **Sir W. Burnett.** xv. + 266 pp. la. 8°. London, 1847.

* **Hann, J.**—Handbuch der Klimatologie. x. + 764 pp., 1 plate, 8°. Stuttgart, 1883.

This is one of the series of the "Bibliothek geographischer Handbücher herausgegeben von Prof. Dr. F. Ratzel."

‖ ———.—Über die klimatischen Verhältnisse von Bosnien und der Herzegowina. 21 pp. la. 8°. (*Sitzb. k. Akad. Wissensch., Bd.* lxxxviii., ii. *Abth., Jahrg.* 1883, *p.* 96.)

Haviland, A.—The essential requisites of a sea-side health resort, and the requirements of a health seeker; with the physical geography and climate of the Isle of Man. A lecture delivered . . . 13th June, 1883. 72 pp. 8°. Douglas, 1883.

|| **Hellmann, G.**—Klima des Brocken. 20 pp. la. 8°. (*Kettler's Zeitschr. Bd.*, iii., *pp.* 5 *and* 61.)

|| **Hoffmeyer, N.**—Klima og Vejrforhold. 70 pp., 1 plate, la. 8°. Kjøbenhavn, 1883. (*Saertryk af Danmarks Statistik*, 1. *Bind*, 4*de Hefte*, *p.* 226.)

Inspector General of Customs, Peking.—Medical reports for the half-years ended 30th September, 1882, and 31st March, 1883. 24th and 25th Issues. With plates, 4°. Shanghai, 1883.

M'William, J. O.—Medical history of the expedition to the Niger during the years 1841–2, comprising an account of the fever which led to its abrupt termination. viii. + 287 pp., 4 plates, 8°. London, 1843.

* **Marcet, W.**—The principal Southern and Swiss health resorts, their climate and medical aspect. viii. + 408 pp., 9 plates, sm. 8°. London, 1883.

Registrar General, London.—Weekly return of births and deaths in London and in twenty-seven other great towns. Vol. xliv., 1883. Nos. 1–52. la. 8°. London, 1883.

Registrar General of Births, Deaths, and Marriages in Ireland.—Quarterly returns of the marriages, births, and deaths registered in . . . Ireland; . . . . 1883. 1st—4th quarters, Nos. 77–80. la. 8°. Dublin, 1883–84.

———.—Weekly returns of births and deaths in Dublin (including its suburban districts), and in fifteen of the principal urban sanitary districts in Ireland, 1883. Vol. xx., la. 8°. Dublin, 1884.

(Rowell, T. I.)—Annual medical report on the Civil Hospitals in the Straits Settlements for the year 1882. 43 pp. f°. s.l.e.a.
Contains some meteorological observations for 1882.

(Sanitary Commissioner of the Punjab.)—Report on the Sanitary Administration of the Punjab for the year 1882. With maps and plates, sm. f°. Lahore, 1883.

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G—EARTHQUAKES.

|| **Rockwood, C. G.**—Notes on American earthquakes. No. 12. 9 pp. 8°. (*Amer. Journ. Sc.*, xxv., *May* 1883, *p.* 353.)

H—ELECTRICITY AND MAGNETISM.

Assmann, [R.]—.—Eine locale Gewittercyclone. 5 pp., 1 plate, la. 8°. (*Zeitschr. Oesterr. Gesellsch. Meteor., Wien*, 1882, *p.* 337.)

|| **Brioschi, F., Contarino, F., e Angelitti, F.**—Determinazioni assolute della inclinazione magnetica nel R. Osservatorio Astronomico di Capodimonte. 7 pp. sm. f°. Napoli, 1883. (*Rend. R. Accad. Sc. Fis. e Mat. di Napoli. Fasc.* 7. *Luglio*, 1883.)

Dechevrens, M.—Variations de l'aiguille aimantée pendant les éclipses de Lune. Régime des vents à Zi-ka-wei, 1877–1882. 33 pp., 3 plates, sm. f°. Zi-ka-wei, 1883.

|| **De La Rue, W., and Müller, H. W.**—Experimental researches on the electric discharge with the chloride of silver battery. Parts i.–iv., 4 parts, with plates and portrait, la. 4°. (*Phil. Trans., Part* i., *vol.* 169, 1878, *pp.* 55 *and* 155; *Part* i., *vol.* 171, 1880, *p.* 65; *Part* ii., *vol.* 174, 1883, *p.* 477.)

|| **Hellmann, G.**—Zur Leistungsfähigkeit des compensirten Magnetometers Weber-Kohlrausch. 2 pp. la 8°. (*Carl's Repert. Exper.-Physik*, xvii., 1881.)

* **Lardner, D., and Walker, C. V.**—A manual of electricity, magnetism, and meteorology. Vols. i. and ii. 2 vols., sm. 8°. London, s.a.

Lefroy, Sir J. H.—Diary of a magnetic survey of a portion of the Dominion of Canada, chiefly in the North-western territories, executed in the years 1842–1844. xxiv. + 194 pp., 6 plates, la. 8°. London, 1883.

Royal Observatory, Greenwich.—Results of the magnetical and meteorological observations made at the Royal Observatory, Greenwich, in the year 1881: under the direction of **Sir G. B. Airy** and **W. H. M. Christie.** v. + xliv. + lxxvii. pp. la. 4°. London, 1883.

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|| **Stewart, B.**—Terrestrial magnetism. 36 pp., 2 plates, 4°. (*Reprinted from the Encycl. Brit.*)

Tifliser physikalisches Observatorium.—Magnetische Beobachtungen . . . in den Jahren 1881–1882. Herausgegeben von **J. Mielberg.** cxvii. + 80 + 80 pp. la. 8°. Tiflis, 1883.

In the Russian language also.

|| **Weihrauch, K.**—Ueber die gegenseitige Einwirkung permanenter Magnete. 72 pp., 1 plate, la. 4°. Dorpat, 1883. (*Nouv. Mém. Soc. Imp. Nat. Moscou*, xiv., *livr.* 4.)

|| **Wijkander, A.**—Observations magnétiques, faites pendant l'expédition de la Véga, 1878–80. 74 pp. la. 8°. (*Vega-Expeditionens Vetenskapliga Iagttagelser. Bd.* ii., *p.* 431. *Stockholm*, 1883.)

|| **Wild, H.**—Bestimmung des Werthes der Siemens' schen Widerstand-Einheit in absolutem electromagnetischen Maasse. (Lu le 20 Decémbre 1883.) 122 pp., 5 plates, sm. f°. St. Pétersbourg, 1884. (*Mém. Acad. Imp. Sc. St. Pétersb.*, vii^e^ *série, Tome* xxxii., *No.* 2.)

|| ———.—Die Beobachtung der electrischen Ströme der Erde in kürzern Linien. 24 pp., 1 plate, sm. f°. St. Pétersbourg, 1883. (*Mém. Acad. Imp. St. Pétersb.*, vii^e^ *série, Tome* xxxi., *No.* 12.)

|| ———.—Observations sur les courants électriques de la terre dans des lignes d'un kilomètre de longueur et leur comparaison avec les variations magnétiques. 8 pp. 8°. St. Petersbourg, 1884. (*Mél. Phys. et Chim.*, xii., *p.* 91.)

I—GEODESY.

[Office of the Surveyor General of India.]—Account of the operations of the great trigonometrical survey of India. Vols. vii. and viii. . . . Prepared under the directions of Lieut.-General **J. T. Walker.** 2 vols., with plates, la. 4°. Dehra Dun, 1882.

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———.—General report on the operations of the survey of India, comprising the great trigonometrical, the topographical, and the revenue surveys under the Government of India, during 1881–82. Prepared under the superintendence of **J. T. Walker.** With plates, sm. f°. Calcutta, 1883.

K—HYDRAULICS, HYDROLOGY, AND TIDES.

Admiralty, London.—Tide Tables for the British and Irish Ports, for the year 1884; also the times and heights of high water at full and change for the principal places on the Globe. Computed by **H. R. Harris.** vi. + 234 pp. la. 8°. London, (1883).

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|| **O'Meara, P.**—The introduction of irrigation into new countries, as illustrated in North-Eastern Colorado. With an abstract of the discussion upon the Paper. Edited by **J. Forrest.** 96 pp., 2 plates, 8°. London, 1883. (*Minutes Proc. Inst. Civ. Eng.*, lxxiii., *Session* 1882–83, *Part* iii.)

|| **Pearson, J.**—Computation of tides: results of theory and observation. 5 pp., 1 plate, 8°. Dublin, 1883. (*A paper read before the R. Irish Acad., Nov.* 13, 1882; *and reprinted from the Proc., 2nd Ser., vol.* iii., *No.* 10, *April* 1883, *p.* 656.)

Service hydrométrique du Bassin de la Seine.—Observations sur les cours d'eau et la pluie centralisées pendant l'année 1881, sous la direction de **Ch. Lefébure de Fourcy** par **G. Lemoine** et **A. de Préaudeau.** 7 plates, f°. Versailles, s.a.

———.—Résumé des observations centralisées . . . . pendant l'année 1881, par **[A.] de Préaudeau,** sous la direction de **[Ch.] Lefébure de Fourcy** et de **G. Lemoine.** 29 pp. la. 8°. Versailles, 1883. (*Ann. Soc. météor. de France,* xxx., *juillet,* 1882.)

L.—METEOROLOGY.—MISCELLANEOUS.

* **Attlmayr, F., Köttstorfer, J., Luksch, J., Mayer, E., Salcher, P., und Wolf, J.**—Handbuch der Oceanographie und maritimen Meteorologie. Im Auftrage des k.k. Reichs-Kriegs-Ministeriums (Marine-Section). 2 vols., with plates, la. 8°. Wien, 1883.

Bebber, J. van.—Typische Witterungs-Erscheinungen. 10 pp., 5 plates, la. 8°. (*Monatl. Uebers. Witterung, Hamburg,* vii., 1882, *p.* 29.)

* **(Buchan, A.)**—Meteorology. 46 pp. 4°. [*Encyclop. Brit.* ,xvi., *p.* 114.]

Campbell, J. F.—Sun-spots and world's weather. 14 pp. sm. 8°. (London, 1884.)

* **(Campbell, J. F.)**—Thermography. 390 pp. sm. 8°. Kensington, 1883.

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|| **Corbett, V. W.**—On water-gaugé, barometer, and other observations taken at Seaham Colliery during the time the Maudlin seam was sealed up. 86 pp., 2 plates, la. 8°. Newcastle-upon-Tyne, 1883. (*Min. of Proc. North Engl. Inst. Mining & Mech. Eng.,* xxxii., 1883, *p.* 225.)

Dreyer, J. L. E.—An historical account of the Armagh Observatory. Armagh, 1883. Printed for private circulation. 20 pp., 1 plate, 8°. Liverpool, s.a.

|| **Hann, J.**—Bericht über die Fortschritte der geographischen Meteorologie. 72 pp. sm. 4°. (*Geogr. Jahrb. von Behm, Gotha,* ix., *p.* 51.)

H(ann), J.—Scott : On the results of observations made at the Pagoda, Royal Gardens, Kew, and elsewhere to determine the influence of height on thermometric readings, on vapour tension and on humidity. Quarterly Weather Report, New series, Part i. [1876], appendix iii. London, 1881. 4 pp. la. 8°. [*Zeitschr. oesterr. Gesellsch. Meteor., Wien.,* xviii., 1883, *p.* 395.]
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|| **Hazen, H. A.**—The sun-glows. 12 pp. la. 8°. (*Amer. Journ. Sc.,* xxvii, 1884, *ch., p.* 201.)

|| **(Hellmann, G.)**—Der südlichste Gletscher Europa's. 6 pp. 8°. (*Verh. Gesellsch. Erdk. Berlin,* 1881, *No.* 10.)

*|| **Klein, H. J.**—Die Fortschritte der Meteorologie. Nos. 5–8, 1877–82, 4 vols. sm. 8°. Köln und Leipzig, 1879–1883. (*Revue der Naturwissensch. herausgegeben von Dr. H. J. Klein.*)

|| **Laughton, J. K.**—An address delivered at the annual general meeting of the Meteorological Society, January 17th, 1883. 13 pp. la. 8°. (*Quart. Journ. Meteor. Soc.,* ix., 1883, *p.* 71.)

|| **Loomis, E.**—Contributions to meteorology. 19th paper, with three plates, la. 8°. (*Amer. Journ. Sc.,* xxvi., 1883, *Dec.*)

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* **Mackenzie, G.**—The system of the weather of the British Islands; discovered in 1816 and 1817 from a journal commencing November 1802. xl. + 224 pp., 2 plates, 4°. Edinburgh, 1818.

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———.—Sunshine records of the United Kingdom for 1881. Reduced from the original traces from 31 stations. viii. + 61 pp., 1 plate, la. 8°. London, 1883.

(Meteorological Office, Bombay.)—Brief sketch of the meteorology of the Bombay Presidency in 1882–83. (By **A. N. Pearson.**) 7 pp., 1 plate, sm. f°. s.l.e.a.

* **Mill, H. R.**—The rainband : how to observe it, and what to expect from it. 38 pp., 1 plate, sm. 8°. London, 1883.

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* **Radau, R.**—La lumière et les climats. 88 pp. sm. 8°. Paris, 1877.

* ———.—Les radiations chimiques du soleil. 90 pp. sm. 8°. Paris, 1877.

‖ **Rundell, W. W.**—Records of bright sunshine. 5 pp. la. 8°. (*Quart. Journ. Meteor. Soc.*, ix., *p.* 166.)

(Russell, H. C.)—The Sydney Observatory. History and progress. 16 pp. la. 8°. (Sydney, 1882.)

* **(Scott, R. H.)**—Meteorology at home and abroad. 7 pp. 8°. [*Longman's Mag., II.*, 1883, *p.* 387.]

‖ **Scott, R. H.**—Weather knowledge in 1883. 11 pp. 8° (London, s.a.) (*Proc. R. Inst. Great Britain*, x., 1883, *p.* 323.)

‖ **Solander, E.**—Om isförhållandena i Sveriges rinnande vatten. 10 pp., 1 plate, 8°. (*Öfversigt af K. Vetensk.-Akad. Forhändl.* 1882, *No.* 1. *Stockholm.*)

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Hydrographisches Amt der k. k. Kriegsmarine zu Pola.—Meteorologische und magnetische Beobachtungen. 1883, Jan.—Dec., and Results. Oblong la. 8°.

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K. K. Central-Anstalt für Meteorologie und Erdmagnetismus, Hohe Warte bei Wien.—Beobachtungen. 1883, Jan.—Dec., and Results. 8°.

K. K. Central-Anstalt für Meteorologie und Erdmagnetismus, Vienna.—Jahrbücher. Jahrg. 1879–81. Neue Folge, xvi.-xviii. Band. (Vorwort von **J. Hann.**) 3 vols., 1 plate, la. 4°. Wien, 1882–84.

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b. BELGIUM.

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APPENDIX XVIII.

METEOROLOGICAL OFFICE: ACCOUNT of RECEIPTS and PAYMENTS for the year ending 31st March 1884.

RECEIPTS.

	£ s. d.	£ s. d.
Balance from year 1882–83		1,087 19 11
Parliamentary Vote		15,800 0 0
Repayment of expenses charged under—		
(1.) Incidental expenses	18 0 5	
(2.) Special researches	22 9 4	40 9 9
SUPPLY OF INFORMATION:—		
D.W. Charts and Forecasts	235 5 7	
6 p.m. Charts	25 0 0	
Information for Press Agencies, &c.	96 14 3	
Telegrams	352 4 5	
Miscellaneous data	36 1 4	745 5 7
SALE OF INSTRUMENTS, &c.:		
Royal Navy (A)	28 5 0	
Mercantile Marine account (B)	62 15 7	91 0 7
Commissions executed for Colonial and Foreign Institutions, &c. (C)		737 4 9
Commission charged on work done for Colonies, &c.		39 12 11
		£18,041 13 6

PAYMENTS.

	£ s. d.	£ s. d.	£ s. d.
ADMINISTRATION:			
Payment of Council	1,000 0 0		
Secretary	800 0 0		
Salaries and wages	742 10 0		
Rent, fuel, and lighting	705 12 1		
Incidental and contingent expenses:—			
Attendance, cleaning, &c.	442 8 2		
Furniture and fittings	84 9 8		
Expenses contingent on International Meteorological Congress	5 11 3		
Pensions	42 16 4	3,823 7	
SPECIAL RESEARCHES		696 4 7	
LAND METEOROLOGY:			
Observatories and stations	2,383 8 7		
Discussion and reduction of observations	1,299 14 1	3,683 2 8	
WEATHER INFORMATION AND FORECASTS:			
Telegraphic reports and storm warnings	3,234 19 11		
Preparation and issue of reports and forecasts	1,474 9 0	4,709 8 11	
INSPECTIONS:			
Salaries and travelling expenses		125 8 5	
OCEAN METEOROLOGY:			
Discussion and reduction of observations	1,756 19 6		
Expenses incidental to the supply of instruments:—			
Proportion for care and issue of instruments	200 0 0		
Royal Navy	194 13 11		
Mercantile Marine	595 7 7		
Distant island and coast stations	36 5 0	2,783 6 0	
Commissions executed for Colonial and Foreign Institutions, &c.		372 17 10	
		16,593 15 11	
BALANCE:			
Cash at Bank	1,310 12 1		
„ at Office	87 5 6		
Advance to Valencia Observatory	50 0 0	1,447 17 7	
		£18,041 13 6	

APPENDIX XIX.

LIST OF PUBLICATIONS, &c. issued under the Authority of the Meteorological Council.

OFFICIAL.

No. 1. Report for 1867. Presented to Parliament. 1*s.*

2. Instructions for Meteorological Telegraphy. New Edition. (1875.) 6*d.*

3. Fishery Barometer Manual. 6*d.*

4. Charts of Surface Temperature, South Atlantic Ocean. 2*s.* 6*d.*

5. Report for 1868. Presented to Parliament. 5*d.*

6. Report for 1869. Presented to Parliament. 10*d.*

7. Quarterly Weather Report for 1869.—Parts I. to IV. 5*s.* each.

8. The Barometer Manual (out of print, see Nos. 24, 40, 60, and 61).

9. Quarterly Weather Report for 1870.—Parts I. to IV. 5*s.* each.

10. Report for 1870. Presented to Parliament. 10*d.*

11. Contributions to our Knowledge of the Meteorology of Cape Horn and the West Coast of South America. 2*s.* 6*d.*

12. Currents and Surface Temperature of the North Atlantic Ocean, from the Equator to Lat. 40° N., for each month of the year, with a General Current Chart. 2*s.* 6*d.*

13. A Discussion of the Meteorology of the Part of the Atlantic lying North of 30° N., for the Eleven Days ending 8th February 1870. Price, with Book of Charts, 5*s.*

14. Quarterly Weather Report for 1871.—Parts I. to IV. 5*s.* each.

15. Report for 1871. Presented to Parliament. 10*d.*

16. Quarterly Weather Report for 1872.—Parts I. to IV. 5*s.* each.

17. Report for 1872. Presented to Parliament. 1*s.*

18. Contributions to our Knowledge of the Meteorology of the Antarctic Regions. 2*s.*

19. Quarterly Weather Report, 1873.—Parts I. to IV. 5*s.* each.

20. Charts of Meteorological Data for Square 3. Lat. 0°—10° N. Long. 20° — 30° W., and Remarks to accompany the Monthly Charts, which show the Best Routes across the Equator for each Month, &c. 20*s.*

21. Report of the Proceedings of the Meteorological Congress at Vienna. 1*s.*

22. Report for 1873. Presented to Parliament. 4*d.*

LIST OF PUBLICATIONS, &c.—*continued.*

No. 23. Report of the Proceedings of the Conference on Maritime Meteorology held in London, 1874. 2*s.*

24. Instructions in the Use of Meteorological Instruments. 2*s.* 6*d.* [Reprint in the Press.]

25. Quarterly Weather Report for 1874.—Parts I., II., and IV. 5*s.* each. Part III., 5*s.* 9*d.*

26. Report for 1874. Presented to Parliament. 6*d.*

27. Charts of Meteorological Data for the Nine 10° Squares of the Atlantic which lie between 20° N. and 10° S., and extend from 10° to 40° W., with accompanying Remarks, ending with the best routes across the Equator. 24*s.*

28. Contributions to our Knowledge of the Meteorology of Japan. By Staff-Commander Thomas H. Tizard, H.M.S. *Challenger.* 1*s.*

29. Report for 1875. Presented to Parliament. 4*d.*

30. Quarterly Weather Report for 1875.—Parts I.—IV. 5*s.* each.

31. Report for 1876–7. Presented to Parliament. 3*s.* 5*d.*

32. A Discussion of the Meteorology of the North Atlantic during August 1873, with 31 Synoptic Charts. 15*s.*

33. Quarterly Weather Report for 1876. (New Series.) Part I., 6*s.*; Parts II.—IV., 5*s.* each.

34. Contributions to our Knowledge of the Meteorology of the Arctic Regions.—Part I., 2*s.*; Part II., 10*s.*; Part III. 6*s.*

35. Report for 1877–8. Presented to Parliament. 1*s.*

36. Report of the Proceedings of the Meteorological Congress at Rome, 1879. 1*s.* 6*d.*

37. Report on the Meteorology of Kerguelen Island. By the Rev. S. J. Perry, S.J., F.R.S. 3*s.*

38. Report for 1878–9. Presented to Parliament. 5*d.*

39. Meteorological Observations at Stations of the Second Order for the year 1878. 20*s.*

40. Aids to the Study and Forecast of Weather, by the Rev. W. Clement Ley, M.A. 1*s.*

41. Report for 1879–80. Presented to Parliament. 1*s.*

42. Report for 1880–81. Presented to Parliament. 1*s.* 2*d.*

43. Charts of Meteorological Data for the Ocean District adjacent to the Cape of Good Hope, with accompanying Remarks. Price of the Charts, 25*s.*; of the Remarks, 7*s.*

44. Report on the Gales experienced in the Ocean District adjacent to the Cape of Good Hope, between Lat. 30° and 50° S., and Long. 10° and 40° E., by Capt. H. Toynbee, F.R.A.S. 7*s.* 6*d.*

45. Meteorological Observations at Stations of the Second Order for the year 1879. 20*s.*

LIST OF PUBLICATIONS, &c.—*continued.*

No. 46. Report on the Storm of October 13–14, 1881. By Robert H. Scott, F.R.S. 1*s.* 6*d.*

47. Rainfall Tables of the British Isles for 1866–80. Compiled by G. J. Symons, F.R.S. 7*s.* 6*d.*

48. Report for 1881–2. Presented to Parliament. 1*s.*

49. Quarterly Weather Report for 1879 (New Series). Appendices and Plates. 27*s.*

50. Quarterly Weather Report for 1880 (New Series). Appendices and Plates. 28*s.*

51. Hourly Readings, 1881. (New Series.) Part I., 10*s.* 6*d.* Parts II., III., and IV., 21*s.* each.

52. Quarterly Weather Report, for 1877. (New Series). Appendices and Plates. 27*s.* Part I., 10*s.* Parts II. and III. (In the Press.)

53. Meteorological Atlas of the British Isles. 5*s.* 6*d.*

54. Hourly Readings, 1882. (New Series.) Parts I. and II. 20*s.* each. Part III., 22*s.* 6*d.* Part IV. (In the Press.)

55. Quarterly Weather Report for 1878. (New Series.) Appendices and Plates. 28*s.*

56. Sunshine Records of the United Kingdom for 1881. 4*s.*

57. Meteorological Observations at Stations of the Second Order for the year 1880. (In the Press.)

58. Report for 188 –3. Presented to Parliament. 10½*d.*

59. Sea Temperature Charts for the Atlantic, Indian, and Pacific Oceans. 21*s.*

60. Principles of Forecasting by Means of Weather Charts. By the Hon. Ralph Abercromby, F.R. Met. Soc. 1*s.* 9*d.*

61. The Barometer Manual for the Use of Seamen. 1*s.* 3*d.*

62. Monthly Weather Reports for 1884:—Jan.–March, May–Nov. 1*s.* 6*d.* each. April (with two Appendices). 2*s.* 6*d.* Dec. (in the Press).

63. Hourly Readings, 1883. (New Series.) Part I. (In the Press.)

NON-OFFICIAL.

No. 1. Report to the Committee on the Connexion between Strong Winds and Barometrical Differences.—By Robert H. Scott, Director of the Office. 6*d.*

2. Report to the Committee on the Meteorology of the North Atlantic.—By Captain H. Toynbee, Marine Superintendent. 1*s.*

3. Report to the Committee on the Use of Isobaric Curves.—By Captain H. Toynbee, Marine Superintendent. 1*s.*

4. Routes for Steamers from Aden to the Straits of Sunda and back. Translated from a Paper issued by the Royal Meteorological Institute of the Netherlands. 6*d.*

LIST OF PUBLICATIONS, &c.—*continued.*

NON-OFFICIAL—*continued.*

5. On the Winds, &c. of the North Atlantic along the Track of Steamers from the Channel to New York. Translated from a Paper issued by the Deutsche Seewarte, Hamburg. 6*d.*
6. Report of the Proceedings of the Meteorological Conference at Leipzig. 1*s.*
7. Notes on the Form of Cyclones in the Southern Indian Ocean.—By C. Meldrum, Esq., M.A., F.R.S. 6*d.*
8. Report on Weather Telegraphy and Storm Warnings. Presented to the Meteorological Congress at Vienna. 6*d.*
9. Report of the Permanent Committee of the Vienna Congress for 1874. 1*s.* 6*d.*
10. On the Physical Geography of the part of the Atlantic which lies between 20° N. and 10° S., and extends from 10° to 40° W. A Paper read before the British Association at Bristol, in August 1875, by Capt. Toynbee, F.R.A.S., F.R.G.S., Marine Superintendent. 1*s.* 6*d.*
11. Report of the Permanent Committee of the Vienna Congress for 1876. 2*s.*
12. Reports to the Permanent Committee of the Vienna Congress on Atmospheric Electricity, Maritime Meteorology, and Weather Telegraphy, 1878. 2*s.*
13. Report of the Permanent Committee of the Vienna Congress for 1878. 6*d.*
14. Report of the International Meteorological Committee, meeting at Berne, 1880. 1*s.*
15. Report of the Second Meeting of the International Meteorological Committee, held at Copenhagen, August 1882. 2*s.* 6*d.*

Published and sold by POTTER, 31 Poultry, and STANFORD, 55, Charing Cross.

The Annual Reports may be obtained at the appointed Sale Offices for Parliamentary Papers, or directly through any Booksellers.

LONDON: Printed by EYRE and SPOTTISWOODE,
Printers to the Queen's most Excellent Majesty.
For Her Majesty's Stationery Office.

REPORT

OF THE

METEOROLOGICAL COUNCIL

TO THE

ROYAL SOCIETY,

For the Year ending 31st of March 1884.

Presented to both Houses of Parliament by Command of Her Majesty,
FEBRUARY 1885.

LONDON:
PRINTED BY EYRE AND SPOTTISWOODE.

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1885.

REPORT

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PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.
FOR HER MAJESTY'S STATIONERY OFFICE.

1885.

[C.—4505.] Price 4*s.* 4*d.*

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FOR HER MAJESTY'S STATIONERY OFFICE.

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164, 6

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THE METEOROLOGICAL COUNCIL,

1884–85.

Lieutenant-General RICHARD STRACHEY, C.S.I., F.R.S., Chairman.

Professor GEORGE HOWARD DARWIN, M.A., LL.D., F.R.S., (appointed February 19, 1885).

MR. WARREN DE LA RUE, D.C.L., F.R.S. (resigned February 19, 1885).

Captain Sir FREDERICK J. O. EVANS, K.C.B., F.R.S., Hydrographer of the Admiralty (resigned June 30, 1884).

MR. FRANCIS GALTON, M.A., F.R.S.

Professor GEORGE GABRIEL STOKES, LL.D., F.R.S.

MR. EDWARD J. STONE, M.A., F.R.S.

Captain WILLIAM J. L. WHARTON, Hydrographer of the Admiralty (appointed July 1, 1884).

REPORT

OF THE

METEOROLOGICAL COUNCIL

TO THE

ROYAL SOCIETY,

For the Year ending March 31, 1885.

Introductory.

Two changes have taken place in the Council during the year. At the beginning of July Sir F. J. O. Evans retired on the expiration of his term of office as Hydrographer of the Admiralty. In January Mr. Warren de la Rue, who had been one of the original members of the Meteorological Committee of the Royal Society intimated his desire of resigning his seat on the Council in consequence of failing health. The Council cannot but record their sincere regret at the termination of their official connexion with these gentlemen, of whom the former had for ten years, the latter for eighteen, taken an active part in the management of the Office. The vacancy caused by Sir F. J. O. Evans's retirement was filled by the appointment of his successor in the post of Hydrographer, Captain W. J. L. Wharton, and Professor George H. Darwin was appointed by the Royal Society to take the place of Mr. de la Rue. The executive officers continue as before:—

Mr. R. H. Scott, M.A., F.R.S., Secretary.
Captain H. Toynbee, F.R.A.S., Marine Superintendent.
Navigating-Lieutenant C. W. Baillie, F.R.A.S., Assistant do.

The present Report is as usual arranged under three headings:—

I. Ocean Meteorology.
II. Weather Telegraphy.
III. Land Meteorology of the British Isles.

PART I.

Ocean Meteorology.

Collection of information.

Collection of Information.—A concise account of the practice at present followed by the Office as regards its dealing with observers at sea will be found in Appendix I. (p. 25).

In one particular the Office has modified its system. Several captains who have sent in very complete records on the forms supplied in connexion with the synchronous work in the Atlantic

Collection of information.

have expressed their readiness to continue observing for the Office, on condition of their not being expected to keep complete logs, such as would be required if they had received a set of instruments on loan. Ten captains have accordingly been supplied with logs, rough book, and instructions on the understanding that they will use their own instruments. These observations will not be confined to the North Atlantic.

A form (Appendix XIII., p. 88) has been prepared for circulation amongst the captains of fast steamers trading to New York and Boston, for the entry of observations of gales, ice, and derelict ships met with during the passage to America. These forms are to be handed on arrival at the American port to the agent of the Chief Signal Office, who telegraphs any important matter to London, as explained in Part II. (p. 16).

Presentation of charts to observers.

Appendix II. (p. 27) contains a list of all the observers who have contributed "excellent" logs during the past year. Some of them have regularly co-operated with the Office for many years; the names which now appear in the list for the first time are as follows:—

Captain's Name.	Ship.
Boynes, Mr. W. C. (First Officer) -	"Carn Marth."
Burton, George - - -	S.S. "British Prince."
Davidson, H. - - - -	S.S. "Oceanic."
Donaldson, R.A. - - -	S.S. "Glenavon."
Dyke, Lieut.-in-Command H. H., R.N.	H.M.S. "Sylvia."
Fullarton, D. - - - -	"Timaru."
Gadd, C. - - - -	S.S. "Parramatta."
Graham, W. Vincent - - -	"Bowfell."
Griffin, E. J. - - - -	S.S. "Spartan."
Halley, E. - - - -	"City of Madras."
Hayward, P. M. - - -	S.S. "Dacia."
Holloway, John - - -	S.S. "Bombay."
Howard, Lieut. W. Vansittart, R.N. -	H.M.S. "Flying Fish."
Hurrell, A. A. - - -	"Carn Marth."
Irving, P. J. - - - -	S S. "Republic."
Kellett, Arthur - - -	S.S. "Calabria."
McFee, J. R. - - - -	"Great Victoria."
Mallandaine, Frederick - -	"Imberhorne."
Marshall, Frederick - - -	"Wiltshire."
Messum, Lieut. S. V. S. S., R.N. -	H.M.S. "Dart."
Moffat, Thomas - - - -	"Westland."
Nowell, S. - - - -	S.S. "British Prince."
Savage, Lieut. W. M., R.N. - -	L.H. Tender "Richmond."
Simpson, A. - - - -	S.S. "Australasian."
Smith, J. - - - -	"Crosshill."
Trant, W. H. - - -	S.S. "Venetian."
Travers, H. de la Cour - -	S.S. "Tartar."
Trott, Samuel - - -	S.S. "Minia."
Watson, Alexander - - -	"Elvira."
Wheaton, N. J. - - -	"Eliza."
White, Elijah - - -	"Marathon."
Wilson, William - - -	"Horsa."

The Council regret deeply to have to record the death of Captain James Lawson who was an "excellent" observer.

Proportion of "excellent" to total number of logs received.

The following is the total number of logs received from April 1, 1884, to March 31, 1885, and the number of logs which have been classed as "excellent":—

Total No. of Logs received.	No. of Excellent Logs.	Per-centage of Excellent Logs.
190	148	78

The average number of logs received annually during the five years, 1879–83, was 155, and the per-centage of excellent logs among these was 69.

The Council take this opportunity of expressing their best thanks to the observers who have assisted them during the past year.

Districts from which observations are obtained.

On the 31st of March 1885 the ships observing for the Office were pursuing the following voyages:—

To Baffin's Bay or Greenland	6
„ North America, East Coast	21
„ „ „ West „	8
Off East Coast of North America	4
To South America, East Coast	18
„ „ „ West „	7
„ Australia and New Zealand, viâ Cape of Good Hope	20
„ „ „ „ Suez	6
„ India, viâ Suez	2
„ India, viâ Cape of Good Hope	21
„ China Seas, viâ Cape of Good Hope	5
„ „ „ Suez	2
In the Red Sea	3
To Mediterranean Ports	5
„ Cape of Good Hope	5
„ West Indies	7
Between British Ports	3
Unknown	9
Total number of ships	152

Appendix III. (p. 30) supplies a list of the logs and of all the documents from stations abroad received at the Office during the year.

In the Report of the Meteorological Committee of the Royal Society for the period of 17 months ending 31st May 1877, an index was given of the information existing in the Office for the Ocean, at that date. The Council append to the present Report a series of 12 maps showing the amount of such information existing on the 31st December 1884.

Synchronous weather charts.

North Atlantic Weather Charts.—The investigation of the weather over the North Atlantic Ocean for the 13 months, beginning August 1st, 1882, and ending August 31st, 1883, the period during which the International System of Circumpolar Observations was carried out, has still continued to employ nearly the whole Marine Branch of the Office.

Steady progress has been made with the work; nearly 3,000 ships have co-operated, and 11,222 forms have been received,

Synchronous weather charts.

yielding an average of 863 for each of the 13 months, and upwards of 400 observations for each day. These figures are exclusive of the returns from land stations, which number about 250. Inasmuch as several of the circumpolar stations fell within the limits of the charts 30° E. to 120° W., their observations have been incorporated, and have rendered the charts for the higher latitudes far more complete than they would otherwise have been.

The principal features of the method adopted for carrying out the investigation, with specimen charts, will be found at pp. 8–10 of the Report for 1884. It is proposed to issue the charts with three days on a page, two pages facing one another, so as to show six days on an opening.

The labour and time occupied in carrying out this investigation and in preparing the charts, which are essential for the purpose, have been much greater than had been anticipated, but the progress already made gives sure indications that the results obtained from it will be of great value and interest, and will further be altogether new to science, and of a nature that could not be obtained in any other way.

The following statement shows the stage at which the work had arrived by the end of March 1885:—

The charts for two months, August and September 1882, were ready for reduction by eidograph.

The whole of the observations for sea and land, up to July 1, 1883, had been entered on the charts.

The isobars and isotherms up to the end of April 1883 had been drawn.

The generalized wind arrows had been entered, and the weather areas drawn up to the end of October 1882.

South Atlantic Weather Charts.—In the beginning of the year 1884 the Council received an application from Dr. Neumayer stating that his office, the Deutsche Seewarte, at Hamburg, intended to prepare daily charts of the South Atlantic for the period above mentioned, and requesting a copy of any data existing in the Meteorological Office for that area, and for the period under examination. The Council readily acceded to the request, and about 13,000 sets of observations have been copied and sent to Hamburg.

Charts of barometrical pressure.

Charts of Barometric Pressure for the Atlantic, Pacific, and Indian Oceans.—These were referred to in the Report for 1884; they correspond to the sea-surface temperature charts recently published, and have been nearly completed, the whole of the data contained in the office logs having been examined for this purpose.

Valuable additions are now being made to the charts from the Remark Books kept by the officers on board H.M. Ships. These observations are especially useful over those parts of the sea which are not frequented by vessels of the Mercantile Marine. It is also intended to use all available observations found in records of the old voyages and in the published documents of foreign countries. This additional work has already made considerable progress, and it is hoped that the whole of the charts will be in the hands of the engraver during the year.

Arctic meteorology.

Contributions to our Knowledge of the Meteorology of the Arctic Regions.—Parts I., II., and III. of this work have been noticed in previous Annual Reports. Part IV. is now in the press and will complete the first volume. The last-named Part deals with documents relating to the following wintering stations, and closes the series of expeditions sent in search of the Franklin Expedition :—

Wintering Stations.	Ships.	Commanders.	Year.	Information already published.
Prince of Wales's Strait.	H.M.S. "Investigator" -	Sir R. McClure -	1850-1	Monthly means of meteorological elements are given in Sir W. Armstrong's "Personal Narrative."
Mercy Bay - -	Do. - -	Do. - -	1851-3	
Dealy Island -	H.M.S. "Resolute" and "Intrepid."	Sir H. Kellett -	1852-3	Abstracts in Capt. McDougall's "Voyage of the 'Resolute.'"
Melville Sound -	Do. do. - -	Do. - -	1853-4	
Beechey Island -	H.M.S. "North Star" -	W. J. S. Pullen -	1852-4	Nothing published.

Barometer Manual for Seamen.

The Barometer Manual for Seamen.—This work, which, as explained in last Report, appeared in the year 1884, has already been translated into German by Herr W. von Freeden and published by the Schulzesche Buchhandlung in Oldenburg. The Council have received and acceded to an application from Italy for the publication of a translation in that country.

Instruments belonging to the Office.

Supply and Stock of Instruments.—In Appendix IV. (p. 45) will be found a list of the meteorological instruments supplied by the Office to ships in the Royal Navy during the year, with a statement of the entire stock and distribution of instruments standing on the books, to the account of the Admiralty, on the 31st March 1885.

Appendix V. (p. 46) gives similar information with regard to the disposal of the other instruments belonging to the Office, which are mainly supplied to the Mercantile Marine.

PART II.

Weather Telegraphy.

Reporting stations.

Telegraphic Reporting Stations.—The service has not been subject to any serious interruption during the year now under review.

Some changes in the arrangements for the receipt of intelligence which were indicated in the last Report have been duly carried out, and the additional information thus obtained has produced a marked improvement in the quality and amount of the data on which the weather forecasts are based.

The station at Dungeness in place of Dover was organised in the month of June, and the reports from the latter station were discontinued at the end of the month.

In the month of July the instruments were forwarded to Belmullet, co. Mayo, in the extreme north-west of Ireland, and the observations from that station have been published since

Reporting stations.

October 1st. Malin Head was not supplied with instruments until the beginning of October, on the occasion of the Inspector's visit, and the reports from thence did not appear in the Daily Weather Charts until January.

In order to relieve the Office from some portion of the extra expense caused by the establishment of these two new stations, it was resolved to discontinue the transmission by wire of the reports from Hawes Junction; the observations at that station are still kept up, and the results forwarded by post, but the experience which the Office has had during four years of the practical value of these reports has led the Council to consider that the expense of telegraphing them might well be dispensed with.

In order to secure a more perfect record of the changes in atmospheric pressure which may occur in the intervals between the observations taken for the telegraphic reports, the Council have resolved to supply self-recording aneroids, on Richard's principle, to some of the outlying stations. These instruments will be issued in the course of the summer of 1885.

A list of the telegraphic reporters will be found in Appendix VI. (p. 47).

Inspection of the stations.

Inspection of the Telegraphic Reporting Stations.—The telegraphic reporting stations have been inspected during the year, in England (including Jersey and the Isle of Man) by the Rev. W. Clement Ley and Mr. D. W. Barker, who undertook part of the duty during the temporary illness of Mr. Ley; in Scotland by Mr. Buchan; and in Ireland and Wales by Mr. Scott. The reports submitted by the Inspectors to the Council, which are printed in Appendix VII. (p. 48), show that the efficiency of the service has been fairly maintained.

Discussion of the reports.

Discussion and Publication of the Information received.—A description of the practice of the Office in the collection, discussion, and dissemination of the meteorological information received by telegraph is given in Appendix VIII. (p. 67). A list of the institutions and persons who received the Daily Weather Reports and Charts free of cost in 1884–5 forms Appendix IX. (p. 77).

Forecasts.

Weather Forecasts.—There has been no material change in the system of preparation and issue of the forecasts during the year.

Forecasts are issued twice a day, at 11 a.m. and at 8h. 30m. p.m. The Forecast prepared at 11 a.m., on the information derived from the 8 a.m. reports, refers to the probable weather between noon on the day of issue and noon on the day following, and is publicly posted up in several places in London,* and supplied to the after-

* Viz., in the City, at the Mansion House, at Lloyd's Rooms, and at Messrs. R. & J. Beck's, Cornhill, and at Messrs. Thos. de la Rue & Co., Bunhill Row; in the West End, in the Libraries of the House of Lords and House of Commons; at Messrs. Elliot's, Strand; Messrs. Stanford's, Charing Cross; Messrs. Negretti & Zambra's, Regent Street; and Messrs. Pastorelli's, New Bond Street.

noon editions of the newspapers. The forecasts prepared at 8h. 30m. p.m. are for the newspapers only.

Inquiries at the Office.

Owing to the additional information afforded to the public by the appearance in so many of the daily papers of the Forecasts now prepared, the number of special inquiries has been small. The inquiries received through the Post Office during the year amounted to 62, and the personal applications to 28. The rules of the Office relating to such inquiries continue the same as in previous years, and are given in Appendix VIII. (p. 75).

Testing of the forecasts.

The results of a comparison of the Forecasts issued at 8.30 p.m. during the year with the weather actually experienced is given in Appendix XII. (p. 83), and the following summary of successes and failures, estimated in the manner explained in that Appendix, shows that the average of success over the whole United Kingdom has been 82 per cent.

SUMMARY OF RESULTS.

Districts.	Percentages.				Total percentage of Success.
	Complete Success.	Partial* Success.	Partial* Failure.	Total Failure.	
SCOTLAND, N. - -	51	33	11	5	84
„ E. - -	54	29	12	5	83
ENGLAND, N.E. - -	52	31	11	6	83
„ E. - -	50	34	11	5	84
MIDLAND COUNTIES -	53	31	11	5	84
ENGLAND, S. - -	55	32	9	4	87
SCOTLAND, W. - -	45	29	16	10	74
ENGLAND, N.W. -	49	30	13	8	79
„ S.W. -	52	29	11	8	81
IRELAND, N. - -	49	32	11	8	81
„ S. - -	46	33	12	9	79
Summary -	51	31	11	7	82

* Note "partial" implies "more than half."

Hay Harvest Forecasts.

Hay Harvest Forecasts.—The Council renewed in 1884 the offer made in the four previous years to the Royal Agricultural Society, the Royal Dublin Society, and the Highland Society to send daily Forecasts *gratis* during the hay season to a number of observers selected by the Councils of those Societies, on the two conditions, that the information should be made as widely known as possible, and that a record should be kept of the value of each prediction and sent in weekly to the Office. The Societies again

Hay Harvest Forecasts.

cordially accepted the proposal, and the following list of recipients was prepared:—

LIST of those who received HAY HARVEST FORECASTS in 1884.

Districts.	To whom sent.	Address.
0. SCOTLAND, N.	Rev. Dr. Joass	Golspie.
	Major Smith	Munlochy, Inverness.
1. SCOTLAND, E.	G. Johnstone	Glamis, by Forfar.
	W. S. Macdonald	Craigielaw, Longniddry.
	A. F. Leslie	Braco Grange, Banffshire.
2. ENGLAND, N.E.	J. Wilson	Chillingham Barns, Belford, Northumberland.
	J. Turner	The Grange, Ulceby.
3. ENGLAND, E.	W. Birkbeck	High House, Thorpe, Norwich.
	Sir J. B. Lawes, Bt., and J. H. Gilbert, Ph.D.	Rothamsted, Harpenden.
4. MIDLAND COUNTIES	Royal Agricultural College.	Cirencester.
	The Duke of Somerset	Gerrard's Cross, Bucks.
5. ENGLAND, S.	C. Whitehead	Barming House, Maidstone.
	E. P. Squarey	The Moot, Downton, Wilts.
6. SCOTLAND, W.	W. Calder	Castle Hill, Dalreoch, Dumbarton.
	M. J. Stewart	Ardwell, Stranraer.
	J. S. R. Ballingal	Eallabus House, Islay.
7. ENGLAND, N.W.	G. W. Wray	Leyburn, Yorkshire.
	The Earl of Derby	Knowsley Hall, Prescot.
	The Lord Egerton of Tatton.	Tatton Park, Knutsford.
8. ENGLAND, S.W.	Colonel J. B. Turbervill	Ewenny Priory, Bridgend, Glamorganshire.
	The Earl of Ducie	Whitfield, Falfield, R.S.O.
	T. Dyke	Long Ashton, Clifton, Bristol.
	R. Neville	Butleigh Court, Glastonbury.
9. IRELAND, N.	Viscount Massereene and Ferrard.	Antrim Castle, Antrim.
	Rev. A Brown	The Manse, Hollymount, Co. Mayo.
	E. F. Farrell	Moynalty, Co. Meath.
10. IRELAND, S.	D. A. M'Cready	Larchvale, Moneygall, King's Co.
	D. A. Milward	Lavistown, Kilkenny.
	W. Talbot Crosbie, D.L.	Ardfert Abbey, Tralee, Co. Kerry.

The general result of this repetition of the experiment of 1879 is shown by the subjoined table, which has been compiled solely from the reports of the above-mentioned gentlemen, and is entirely independent of any estimate formed within the Office itself:—

SUMMARY of RESULTS. Hay Harvest Forecasts.

Districts.	Names of Stations.	Percentages.				Total percentage of Successes.
		Complete Success.	Partial Success.	Partial Failure.	Total Failure.	
SCOTLAND, N. -	Golspie and Munlochy - - -	39	43	16	2	82
„ E. -	Glamis, Longniddry, and Grange -	38	45	15	2	83
ENGLAND, N.E. -	Ulceby and Chatton, Northumberland	48	35	14	3	83
„ E. -	Thorpe and Rothamsted - -	56	38	4	2	94
MIDLAND COUNTIES	Cirencester and Gerrard's Cross -	43	44	11	2	87
ENGLAND, S. -	Maidstone and Downton - -	53	42	5	—	95
SCOTLAND, W. -	Islay, Dumbarton, and Stranraer -	50	37	12	1	87
ENGLAND, N.W. -	Leyburn, Prescot, and Knutsford -	41	40	15	4	81
„ S.W. -	Bridgend (Glamorgan), Falfield, Clifton, and Glastonbury.	31	47	16	6	78
IRELAND, N. - -	Antrim, Hollymount, and Moynalty -	32	49	13	6	81
„ S. - -	Moneygall, Kilkenny, and Ardfort Abbey (Tralee).	37	42	18	3	79
	Mean for all districts, 1884 - -	43	42	12	3	85
	„ „ 1883 - -	53	35	10	2	88

Remarks:—The result of the checking shows that the general per-centage of success (85) was 3 less than last year. The districts showing the highest figures were England, S., (95) and England, E., (94), while the smallest proportion of good forecasts (78) was in England, S.W.

Major Smith says that the forecasts were correct on the whole, particularly those from the 12th–16th August, the forecasts on those days being "very satisfactory," and Messrs. Birkbeck and Dawson Milward both remark that "the forecasts have been very successful."

The most practical proof of the utility of the service is furnished by the fact that the proposal to cease the forecasts was followed in several instances by a request for their further continuance, and in some by payment of the cost for some weeks.

Storm Warnings for the Coasts of the United Kingdom.—In Appendix XI. (p. 81) will be found the names of the stations which are furnished with signals for Storm Warnings, in accordance with Circular 717 of the Board of Trade issued in February 1874. Storm warnings.

These stations were, at the end of March 1885, 139 in number, situated:—

68 in England, 13 in Wales, 37 in Scotland, 15 in Ireland, 3 in the Isle of Man, and 3 in the Channel Islands.

Results of storm warnings in 1884.

The usual comparison has been instituted in the Office between the warnings issued in 1884 and the weather experienced on our coasts, the warnings being tested by the method explained in Appendix VIII. The results of the comparison are shown in the following tables:—

RETURN of the Result of the Comparison between the Warnings issued and the Weather experienced in 1884.

Coasts.	Total No. of Orders to hoist and repetitions.	Warnings justified by subsequent Gales. Force 8 and upwards.	Warnings justified by subsequent strong Winds. Forces 6 and 7.	Warnings not justified by subsequent Weather.	Warnings late. Force 9 reached at two Stations before issue.	Warnings partially late. Force 9 reached at one Station before issue.	Warnings in Error owing to Telegraphic mistakes.	Storms for which no Warning was issued.
Ireland, South -	59	43	8	5	—	3	—	
„ East -	60	38	17	5	—	—	—	
Scotland, East -	57	35	10	10	—	1	1	Oct. 28.
„ West -	50	34	12	4	—	—	—	
England, North-west	56	46	3	7	—	—	—	
„ West -	51	30	12	9	—	—	—	
„ South -	52	34	11	7	—	—	—	Sept. 7,* Oct. 26.
„ South-east	32	19	10	3	—	—	—	
„ East -	44	27	9	6	—	1	1	Oct. 28.†
Totals - -	461	306	92	56	—	5	2	
Per-centages -		66·4	20·0	12·1	0	1·1	0·4	

* These gales were not severe. † Not felt south of Hull.

With regard to the storms for which no warning was issued, it should be remarked that (1)—

The force of the wind experienced in "England, South," on September 7th and October 26th, did not exceed 8 at any station on that coast, but that force was reached so very generally that the disturbance has been counted as a gale.

The omission to warn in the first case was caused by the fact that on the 6th the changes in pressure, wind, &c. gave reason for expecting that the storm would take a more northerly course than it did, and that the southern parts of the kingdom would escape with only a strong breeze. In the second case the depression proved to be so much deeper than could have been possibly foreseen at 6 p.m. on the 25th, and the gale (which, like that of September 7th, was duly warned for in other parts) spread further to the southward than was expected.

The only gale of importance which was not warned for during the year was that felt in the "Scotland, East," and "England, East," on October 28th. This was occasioned by numerous errors in the telegrams for 6 p.m. on October 27th. The isobars could not be accurately drawn in consequence, and the storm took a more northerly course than was expected, thus involving

those districts in the gale, which was not expected to prevail further north than Hull.

The following table contains a comparative statement of the storm warnings and their results in 1884, and in the ten preceding years. It will be seen that the percentage of warnings justified is the highest yet attained. Comparison of results for 1884 with previous years.

Years.	Total No. of Warnings issued.	Warnings justified by subsequent Gales.	Warnings justified by subsequent strong Winds.	Total Warnings justified.	Warnings not justified by subsequent Weather.
1874	317	45·4	32·8	78·2	16·4
1875	248	41·1	35·1	76·2	21·0
1876	265	61·1	21·5	82·6	11·7
1877	475	53·3	25·9	79·2	16·4
1878	485	56·7	20·8	77·5	17·9
1879	509	50·5	25·1	75·6	20·6
1880	390	58·2	24·6	82·8	13·3
1881	454	58·6	23·3	81·9	14·8
1882	503	61·4	21·1	82·5	14·9
1883	610	56·2	21·6	77·8	20·8
1884	461	66·4	20·0	86·4	12·1

A return of all the gales since 1873 for which no warning has been issued by the Office has been presented to the House of Lords (Parliamentary Paper, 248).

The numbers in each year are:—1874, 11; 1875, 11; 1876, 15; 1877, 15; 1878, 8; 1879, 10; 1880, 14; 1881, 12; 1882, 13; 1883, 7.

These figures are, however, not very conclusive, as many of the gales enumerated were very local, only affecting a limited portion of the coasts, and the several years are not properly comparable with each other.

Fishery Barometers.—In connexion with the subject of storm warnings, the supply of public, so-called "fishery," barometers to the coast may be mentioned. The whole number of stations on our coasts supplied with these instruments by the Office is at present 168, being the same as in the previous year. Of these stations, 58 are in England, 5 in Wales, 47 in Ireland, 54 in Scotland, 3 in the Isle of Man, and 1 in Jersey. The list is given in Appendix X., p. 80. Fishery barometers.

Observations on Ben Nevis.—The arrangements with the Directors of the observatory established on the summit of Ben Nevis, at a height of 4,000 feet above the sea, have been reconsidered during the past year. The Meteorological Council having carefully examined the question of the probable utility of regular daily telegraphic reports from this station, and of the necessary outlay they would involve, were unable to avoid the conclusion that the practical value of such daily reports in aiding the preparation of the weather forecasts and issue of storm warnings, for which alone they would be of utility, would not be sufficient to justify their cost. They therefore proposed to the Directors that the observatory should send to the Meteorological Office telegrams Observations on Ben Nevis.

Observations on Ben Nevis.

only of any sudden changes of conditions which appeared important, and that copies of the other observations should be sent in writing from time to time. This was agreed to by the Directors, and the Council have in return agreed to continue the grant of 100*l.* yearly towards the expenses of the observatory, at the same time expressing a regret that the demands of other descriptions on the funds at their disposal has precluded their making a larger contribution to that institution.

Atlantic telegrams.

Atlantic Telegrams.—Suggestions for obtaining telegraphic reports of weather from the coasts of North America and from vessels that have crossed the Atlantic have frequently been under the consideration of the Council, but the probable utility of such reports did not appear to justify the expense.

In the course of the summer of 1884, however, a suggestion to the same effect was made by Professor Mascart, Director of the Central Meteorological Office in Paris, offering to share the expense with the Council. This led to a reconsideration of the subject, with the result that the Council came to the conclusion that an experimental arrangement of the suggested description might be attempted.

They therefore resolved to enter into communication with the Hydrographer of the United States Navy, or the Chief Signal Office, Washington, with a view to obtaining from outward-bound steamers on their arrival at New York and Boston telegraphic reports of storms met with in the western portion of the Atlantic. It was considered that as the facts, so far as hitherto recorded, indicate that the cyclonic disturbances which have been traced across the Atlantic require at least four to five days for their passage from the coast of America, timely intelligence of the approach of such disturbances to the coasts of western Europe might be transmitted by wire from the port of arrival of ships that had encountered them on their voyages from Europe.

Accordingly, on the recent visit of the Chairman of the Council, Lieut.-General Strachey, to Washington, on the occasion of the International Meridian Conference, negotiations were opened with the Chief Signal Office of the United States in that city. General Hazen at once entered most cordially into the scheme, and it was arranged that instructions should be given to his agents at New York and Boston to collect from incoming steamers reports of storms met with west of the meridian of 45° W., as well as of ice or derelict ships seen on any part of the voyage, the latter classes of information being of especial importance to seamen.

Forms have accordingly been prepared for issue to captains of the fast steamers that cross the Atlantic from England, which they are requested to forwarded to the Signal Office agent on arrival at either of the ports named, and a system of telegraphing has been arranged with the Signal Office. A specimen of this form is given at Appendix XIII., p. 88. The service was commenced in November 1884, and has now been satisfactorily brought into working order.

It cannot be said that the information as to the weather thus received has yet been of a nature to improve the forecasts, or to

indicate the approach of atmospheric disturbances from the Atlantic; but the experiment seems worth a longer trial.

Publications.—The Weekly Weather Report has appeared in its enlarged and improved form, as explained in the last Report, and has been completed by the addition of two Appendices. Of these Appendix I. gives:— Publications.

a. For the past 19 years for the several districts, for each quarter and for the year, the summary of rainfall and of mean temperature.

b. For the past seven years, for each Month, and with Progressive values from the commencement of each year—

The number of days with rain.

The rainfall in inches.

The accumulated heat in day-degrees above and below 42° respectively.

c. For the past four years (five years from April 1), the number of hours of bright sunshine, and the per-centages of its possible duration.

Appendix II. gives the Weekly and Progressive values of the same elements for seven years as under *b.*, and four years as under *c.*

The Monthly Weather Report has also appeared regularly.

The Principles of Forecasting by means of Weather Charts.—This work, which was prepared by the Hon. Ralph Abercromby, F.R.Met.Soc., at the request of the Council, as explained in the Report for 1879, and the completion of which was delayed for several years by his protracted illness, has now been published. The subjects of which it treats are classified by the author under the following heads: Synoptic Charts; Gradients and Wind; Isobars and Weather; Weather Sequence; Weather Forecasting; Storm Warnings. It is illustrated by 65 woodcuts.

Simultaneous Observations.—The Office has continued its co-operation with the system of simultaneous observations, taken once in every 24 hours, which was organised ten years ago at the request of the Chief Signal Officer of the United States. Simultaneous observations.

A form for the entry of the simultaneous observations is bound up with every ship's log issued by the Office.

In previous Reports it has been stated that the Lords Commissioners of the Admiralty had, at the request of the Council, issued instructions for these observations to be taken (in addition to those made by the Service Regulations) on board each detached ship-of-war on foreign service; or, in the case of a squadron acting together, on board the ship of the senior officer. The number of these observations which have been received during the year from the Royal Navy has been 7,000, and from the Mercantile Marine, 8,500.

Observers at Land Stations.—The list of observers at land stations for 1884 is given in Appendix XIV., p. 89.

PART III.

Land Meteorology of the British Isles.

Observatories and Stations.—Records of the climate of the British Isles are received by the Office from stations with different degrees of fulness of organisation, which may be arranged in five classes.

Self-recording observatories.

1. The Observatories furnished with self-registering instruments by which all the principal meteorological phenomena are recorded continuously, and which thus afford materials for the study of the periodic variations of the meteorological elements.

Anemographic stations.

2. Anemographic stations furnished with instruments registering the wind only. The records from these stations relate to weather as distinguished from climate, and are especially useful in connexion with the passage of storms, and as affording evidence available in the courts of law with respect to collisions at sea, and damage done by wind.

Stations of Second Order.

3. Stations of the Second Order furnishing climatological information from eye observations taken twice a day. The observers at these stations are all volunteers.

Telegraphic Reporting Stations.

4. The Telegraphic Reporting Stations at which eye observations are taken, forming the material upon which the daily weather reports and forecasts are based. The hours of observation at these stations are limited by the requirements of the telegraphic system, as explained in Part II., but the data which they furnish are utilized to afford climatological information for parts of the country where Stations of the Second Order do not exist.

Extra stations.

5. Extra stations furnishing returns with less completeness, and with less detail than those of class 3.

A detailed account of these several stations and of the methods employed by the Office in dealing with the records they respectively furnish will be found in Appendix XV., p. 90.

Documents received.

Appendix XVI., p. 95, contains a list of all documents relating to the land meteorology of the British Isles received at the Office during the year.

Changes in the observatories.

The foundation stone of the new observatory at Falmouth, the intended erection of which was noticed in the last Report, p. 19, was laid in the month of August, and the building is now so far completed that the meteorological instruments are shortly to be transferred to it. The Council has undertaken to bear the cost of erecting the instruments, in addition to the yearly grant of 250*l.* for the maintenance of the observations, which are continued for the present at the old observatory.

At Glasgow the arrangements for the maintenance of the self-recording meteorological instruments by local subscriptions are not yet completed, but through the zealous action of Prof. Grant, the continuity of the observations has not been hitherto

interrupted, and it is still hoped that the means of maintaining the record in the future will be obtained. Changes in the observatories.

At Armagh the records of the self-registering instruments finally ceased from December 1883, but the observations of the second order continue to be made, in aid of which the Council has granted a yearly sum of 50*l.*

The Council have to express their deep regret at the death, at a very advanced age, of the Rev. C. Clouston, LL.D., who took charge of the anemograph at Sandwick Manse in the Orkneys Dr. Clouston had been a regular meteorological observer, either at Sandwick or at Stromness, for more than 60 years, and was the recognized authority for scientific information of all kinds relating to the Orkneys. The Council have applied to the Scottish Meteorological Society for advice as to the continuance of the observations, and they have reason to hope that the Society may be able to secure the services of Dr. Clouston's successor.

Inspection of the Stations.—The self-recording observatories and the anemographic stations (Classes 1 and 2), as well as the Telegraphic Reporting Stations (Class 4), are regularly visited each year by the Inspectors of the Office, before mentioned (p. 10). The extra stations (Class 5) are inspected as opportunity offers. Of the Stations of the Second Order (Class 3), some belong to the Royal Meteorological Society; these are visited by an Inspector appointed by the Society, an allowance being made by the Office toward the cost of the inspection, in accordance with the recommendation of the Treasury Committee (1877). The remaining Stations of the Second Order, which are in immediate connexion with the Meteorological Office, are visited at least once in every two years by the Inspectors of the Office. The Superintendent of the Kew Observatory, Mr. G. M. Whipple, is specially employed to inspect and report on the self-registering apparatus, and on the photographic processes at the observatories. Extracts from the Reports of the Inspectors of the Office and of Mr. Barker, who was charged with the duty of inspection in England during Mr. Ley's illness in the summer of 1884, will be found in Appendix VII., p. 48. Inspection of the stations.

Information supplied to the General Register Office, Ireland.—Reports from nine of the Irish stations of the Office have been regularly supplied to the Registrar General for Ireland, for use in his Weekly and Quarterly Returns. Reports supplied to Registrar General for Ireland.

Quarterly Weather Report.—Parts I. to III. of the volume for 1877 of this publication have been issued, and good progress is being made towards clearing off the arrears. Publications.

The volume of the Monthly Weather Report for 1884, which takes the place of the Quarterly Weather Report, has appeared (see p. 17).

The publication of the Hourly Readings from the seven observatories has been continued. The volume for 1882 has been published, and that for 1883 is well advanced.

Publications.

The tables of monthly and five-day means from the observatories for the years 1881 and 1882 have appeared in the volume of Hourly Readings for 1882.

Reports from Stations of the Second Order.—The volume for 1880 has appeared, and it contains, in addition to the information given for previous years, a table showing the monthly amounts of bright sunshine recorded at various stations, with the percentages of total possible duration. The volume for 1881 is in hand.

Special Researches.

The Harmonic Analyser.—A memorandum on the work done with this instrument will be found at Note A, p. 22.

An instrument has been constructed, from designs by the Chairman, for producing the graphical representation of the harmonic components of thermometrical and barometrical curves, and it will be applied to the results obtained from the harmonic analyser. The instrument is arranged so as to draw the curves of the first four orders, and can be adjusted for their varying amplitudes and hours of maximum.

Electrical Anemometer.—The electrical anemometer referred to at page 24 of last Report as being constructed by Mr. Preece, of the Telegraph Department, has been erected at Kew for preliminary trial, but some of the mechanism is found to require modification, and the instrument is still in the experimental stage, though its ultimate success is not doubted.

Hand Anemometer.—A few experimental hand anemometers have also been constructed in view of obtaining a more definite record of the wind's force or velocity than can be secured by the present system of estimate. One of these has been tried at one of the lightships under the authority of the Trinity Board, and another is under observation at Kew. The results are not yet sufficiently advanced to admit of any conclusion as to the suitability of this form of instrument for general use.

Movement of Clouds.—The experiments for ascertaining the direction and velocity of the upper currents of the air by shell firing have not been much extended, the Council not having the necessary facilities at their command for the purpose. But there is reason to think that the plan can be carried out usefully, and it is hoped that arrangements may still be made that will accomplish this.

The determination of the distance and movement of clouds, photographically, before noticed (see Report, 1884, p. 23), still continues to be experimented on at Kew, but the results in this case also have not yet been of such value as to call for special notice.

Eruption of Krakatoa.—At the desire of the Special Committee of the Royal Society charged with collecting data relative to the eruption at Krakatoa, the Council have undertaken to prepare a report on the atmospheric disturbance which accompanied the great final explosion. A considerable number of automatically recorded barometric traces have been received and examined, and the results are being carefully dealt with.

Library.

The library contains standard works on Meteorology and the allied sciences. It consists at present of nearly 9,000 volumes and pamphlets, exclusive of charts and MS. records of observations. The books and other documents are accessible to scientific men. Library.

Appendix XVII., p. 99, contains a list of the accessions to the library during the year. The volumes marked with an asterisk have been purchased.

In conformity with a practice now generally recommended by authorities on bibliography, all books and pamphlets received during the year have been catalogued upon cards, besides being entered in the existing reference catalogues.

Expenditure.

Appendix XVIII., p. 126, shows the receipts and payments during the year ending 31st March 1885. The amount voted by Parliament was 15,300*l.*, as in the previous year. Financial.

The following abstract of expenditure shows the amount properly chargeable to the year in question, and its distribution under the various heads, together with the increase or decrease in 1884–85, as compared with the previous year :—

Net Expenditure.	1883-84.	1884-85.	Increase.	Decrease.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Payment of Council -	1,000 0 0	1,000 0 0	—	—
Secretary - -	800 0 0	800 0 0	—	—
Office salaries - -	742 10 0	758 16 0	16 6 0	—
Rent, fuel, and lighting -	713 17 7	716 8 2	2 10 7	—
Alterations to premises, attendance, and contingencies - -	466 16 2	424 5 9	—	42 10 5
Expenses incidental to International Meteorological Congress -	5 11 3	—	—	5 11 3
Pensions - -	42 16 4	42 16 4	—	—
Special Researches -	660 8 8	989 8 2	328 19 6	—
Land Meteorology -	3,684 17 7	3,051 1 9	—	633 15 10
Weather Information -	4,026 0 1	4,066 6 10	40 6 9	—
Inspections - -	525 8 5	560 12 1	35 3 8	—
Ocean Meteorology -	2,694 18 1	2,445 6 2	—	249 11 11
Total - £	15,863 4 2	14,855 1 3	423 6 6	931 9 5

(Signed)

Rd. STRACHEY,

Chairman of the Council.

NOTE A.

NOTE on the WORK done with the HARMONIC ANALYSER.

The work hitherto done with the harmonic analyser has been confined almost exclusively to the determination of the air temperature constants, from the photographic thermograms, of the following seven observatories:—

Valencia,	Glasgow,	Falmouth,	Kew.
Armagh,	Aberdeen,	Stonyhurst,	

The curves dealt with have been those for the 12 years 1871 to 1882, inclusive, those for the years 1879, 1880, 1881, and 1882 having been analysed during the past twelve months; at the present time the whole of the results obtained from the machine are being examined and checked preparatory to their publication.

In the Report of the Meteorological Council for 1880, p. 46, *et seq.*, there is a note by Professor Stokes on the employment of the machine, with rules for the use of the same, in which the method to be employed in dealing with breaks in the continuity of the curves is indicated. It may, however, be of use to give here a rather more detailed account of the operations involved in the treatment of the curves, with an example of the manner in which the readings of the machine are recorded and dealt with.

The machine is furnished with three pairs of recording cylinders and discs, numbered consecutively 1 to 6, which give the coefficients for the first three pairs of terms of the expansion, and in addition a seventh cylinder and disc from which the mean is obtained. In the thermograms which supply continuous photographic records of the march of temperature, the trace for 24 hours covers a length of 8·75 inches, while a vertical height of about 0·7 inch* corresponds to a range of ten degrees in temperature; each thermograph sheet contains the record for 48 hours.

Conveniently placed in the machine is a cylinder or drum, the circumference of which is equal to the length of 24 hours upon the thermograms. Round this cylinder the thermograms are rolled, the fluctuations of temperature indicated by the curves being followed, as the cylinder revolves, by a combination of the movement of the cylinder with that of a pointer moving in a line parallel to its axis.

The handle by which the cylinder is turned gives motion at the same time to the seven discs of the machine, and the operator thus controls by his left hand both the speed with which the curves are paid through the machine and the consequent velocity of the angular motion of the discs, while by a suitable contrivance the movements of the pointer, governed by his right hand, produce on the face of the discs corresponding movements to the right or left of the balls by which the motion of the discs is conveyed to the recording cylinders.

At the commencement of an operation all the cylinders are set to zero; the twelve months curves are then passed consecutively

* This value varies slightly for each observatory.

through the instrument; the first pair of cylinders, which gives the coefficients of the first order, and also the mean cylinder, 7, being read for each day, while cylinders 3 and 4 and 5 and 6, which give the coefficients of the second and third orders respectively, are only read for each five days and at the end of each calendar month. The numbers on the cylinders are, however, progressive, so that the increments upon them for any given period could very easily be obtained. The form in which the readings are recorded is as follows:—

READINGS of the RECORDING CYLINDERS of the HARMONIC ANALYSER.
Dry-bulb Thermometer Curves, from July 30 to August 3, 1882.
Kew Observatory.

Month and Day.	First Order.				Second Order.			
	Cylinder 1.		Cylinder 2.		Cylinder 3.		Cylinder 4.	
	Reading at Midnight.	Difference from last Reading.	Reading at Midnight.	Difference from last Reading.	Reading at Midnight.	Difference from last Reading.	Reading at Midnight.	Difference from last Reading.
June 30 - -	+10·480	—	−12·333	—	−3·953	—	−3·256	—
July 30 - -	+12·540	+0·103	−14·926	−0·118	—	—	—	—
„ 31 - -	+12·678	+0·138	−15·004	−0·078	−4·054	±0·000	−3·454	−0·080
August 1 - -	+12·773	+0·095	−15·069	−0·065	—	—	—	—
„ 2 - -	+12·814	+0·041	−15·207	−0·138	—	—	—	—
„ 3 - -	+12·897	+0·083	−15·287	−0·080	−4·084	−0·030	−3·466	−0·012

Month and Day.	Third Order.				Mean.		Midnight reading of Curve.	Difference from last Reading.
	Cylinder 5.		Cylinder 6.		Cylinder 7.			
	Reading at Midnight.	Difference from last Reading.	Reading at Midnight.	Difference from last Reading.	Reading at Midnight.	Difference from last Reading.		
June 30 - -	−1·877	—	−1·827	—	− 2·285	—	—	—
July 30 - -	—	—	—	—	+52·637	+2·302	—	—
„ 31 - -	−2·674	−0·031	−2·391	−0·032	+54·554	+1·917	—	—
August 1 - -	—	—	—	—	+57·177	+2·623	—	—
„ 2 - -	—	—	—	—	+59·753	+2·576	—	—
„ 3 - -	−2·796	−0·112	−2·456	−0·065	+61·299	+1·546	—	—

At present only the monthly increments of the readings have been dealt with, so as to obtain the coefficients of the mean daily variation for each month of the year. The process followed is, therefore, simply to divide the monthly increment by the number of days in the month, and then to multiply the quotient by a

factor which is determined by the scale-value of the thermograms, and which will therefore be different for each observatory.

The ratios of the factors for cylinders 1 to 6 to that of number 7 were very carefully determined from a series of experimental curves of which the values were known. The numerical factor is obtained for each observatory by obtaining on cylinder No. 7 the scale reading corresponding to a vertical movement of the pointer of 10° on the thermogram, which in the case of Kew is ·075 inch. The factor for cylinders Nos. 1 and 2 is eight times that for cylinder No. 7; the factor for Nos. 3 and 4 is four times that quantity, and for Nos. 5 and 6 is eight thirds of that quantity. The signs of the factors depend on the direction in which the discs and cylinders are caused to revolve. The constant quantity, added to the reduced reading of cylinder No. 7 corresponds to the temperature which is assumed as the zero at the commencement of the operation.

As an illustration, the case of Kew for July 1882 may be taken, the final readings of the cylinders for which month are above given. The increments for the month shown by these figures are as follows:—

Cylinder	1.	2.	3.	4.	5.	6.	7.
Observed increment	+ 2·198	− 2·671	− 0·101	− 0·198	− 0·797	− 0·564	+56·839
Divided by 31 (the number of days)	+ 0·071	− 0·086	− 0·003	− 0·006	− 0·026	− 0·018	+ 1·834
Factor	−53·52	+53·52	−26·76	−26·76	−17·84	−17·84	+ 6·69
Coefficient deduced	− 3·80	− 4·60	+ 0·08	+ 0·16	+ 0·46	+ 0·32	+12·27
					Add constant		48·17
					Mean temperature		60·44

APPENDIX.

APPENDIX I.

"Collection of Data from Ships."

The method which has been followed by the Office, since its first establishment in 1854 up to the present date, in the collection of information on Ocean Meteorology, has been to supply officers of the Mercantile Marine with a complete outfit of verified instruments, on the condition of their returning the instruments, and the log of observations made with them, to the Office, or to one of the agents mentioned below, at the completion of the voyage.

Every instrument supplied has been originally verified at Kew Observatory, and on the completion of the voyage it is compared with a standard instrument either at the Office or by one of its agents. Under ordinary circumstances it is not requisite to send the instruments to Kew for re-verification after every voyage, as the changes in their errors are generally slight.

The regular outfit of a ship consists of :—

1 Barometer (Kew pattern).
6 Thermometers, with a thermometer screen.
4 Hygrometers.

The first record of observations is made in a Rough Book supplied for the purpose, which is retained by the captain, who copies the observations into a Meteorological Log kept for the Office.

In order to facilitate the communications between the Office and the observers, agencies are established at some of the principal ports, and instruments are supplied directly from such agencies to the ships.

The following is a list of the agents at present in connexion with the Office :—

Aberdeen	J. R. Jones	Navigation School.
Cardiff	Captain Fowler	Sailors' Home.
Dundee	Leonard Allen	Navigation School.
Glasgow	D. M'Gregor	37 and 38, Clyde Place.
Greenock	Do.	36, Brymner Street.
Hull	Z. Scaping	Trinity House.
Liverpool	J. Gill	Sailors' Home.
Southampton	C. H. Permain	13, Oriental Place.

A set of instruments is kept in working order at the Office in London and at each agency. When a captain expresses himself willing to observe, he is invited to inspect the instruments and learn what will be required of him. If this takes place at one of the agencies, and the captain decides to undertake the work, his name is submitted to the Marine Superintendent, who, if the owners of the ship are British subjects, and she is likely to return to some port in the United Kingdom, sanctions the supply, having due regard to the nature of the proposed voyage and giving preference to captains intending to visit the districts whence the information existing in the Office is scanty.

In a few exceptional cases captains are supplied at ports where there are no agencies, and in these cases the instruments are sent from the Office in London.

Agents receive a fee of 1*l.* 5*s.* for each case of supply and return of instruments, and an additional fee of 1*l.* for the first "excellent" log sent in by any observer whom they may have invited to begin keeping a log, but the Council reserve to themselves the right of deducting the fees for both supply and return of the instruments, if no log is returned, or one which is worthless.

Captains are requested to give notice of their return to any port in the United Kingdom to the agent at the port, if there be one, or else to the Office in London, and steps are then taken to send for the instruments and log. The latter is sent up to London, and the instruments are at once compared with a standard set, and if received at an agency, the results of such comparison are duly forwarded to London.

As regards the Royal Navy, Her Majesty's ships have been supplied by the Office, since its foundation in 1854, with the meteorological instruments used in the service, and for this provision is annually made in the Estimates furnished by the Office to the Treasury upon which the vote for the Meteorological Council is based. The records of observations made by naval officers are in due course deposited at the Admiralty, where they are available for use. It is optional with the observers to keep for the Office a Meteorological Log in addition to the regular record of observations required by the rules of the service. The Council are glad to say that they receive from time to time Meteorological Logs of high value from Her Majesty's ships.

Meteorological Logs received at the Office, whether from Her Majesty's ships or from the Mercantile Marine, are tested according to a definite form (the "test sheet," which has been published in the Report of the Maritime Conference of London, 1874, p. 35), and the observations are classified according to their quality.

As soon as this first testing has been effected, a letter is written to the captain, and if any questions arise to which he can probably give an answer, he is requested to do so while the incidents are fresh in his memory. The replies are noted in the log for future reference.

The method of discussion varies according to the object proposed and the amount of data to be dealt with.

If it is proposed to discuss all the meteorological observations in a given part of the sea, they are first transcribed into data books; an account of the way in which the data books are prepared and used has been given in previous Reports.

If only one element (such as the surface temperature of the sea) is to be discussed, it has been found best to plot the data directly from the logs in geographical position on a chart, and to deduce from the chart means for spaces as small as the number of the observations will allow.

Daily Synchronous Meteorological Observations at Noon, Greenwich Mean Time.

In addition to the meteorological logs received from the Navy, owing to the kindness of the Lords Commissioners of the Admiralty, a full set of observations is made at one time each day by all of Her Majesty's ships, in whatever part of the world they may be stationed. These are entered on monthly forms, and forwarded to the Office as soon as possible after the end of each month. Officers of the Mercantile Marine who are keeping meteorological logs, are also invited to co-operate in keeping the synchronous observations, and in numerous instances the observations are well and regularly made. By these means the Council are in early possession of valuable observations which cover, to some extent, the navigable seas of the whole Globe.

APPENDIX II.

LIST of CAPTAINS (and Officers) who have sent in Logs classed as "Excellent" during the year ending March 31, 1885. The figures opposite to each show the total number of such Logs which they have returned to the Office during the period that they have been observing.

Captain's Name.	Number of "Excellent" Logs.	Ship.
Aldrich, Pelham, R.N. -	8	H.M.S. "Sylvia."
Balderston, Richd. James -	5	"Belfast."
Balfour, Lieut. Andrew, R.N. -	13	H.M.S. "Magpie."
Barker, Mr. D. W., F.R.Met.Soc.	6	"Superb."
Barlow, A. E. - - -	9	S.S. "Parramatta."
Becket, Alexander - -	6	"Amana."
Berridge, Henry - -	5	"Superb."
Blake, Edwin John - -	10	"Tilkhurst."
Bolton, S. H. - - -	4	S.S. "Tyne Queen."
Bouchette, Francis James -	4	S.S. "Montreal."
Boynes, Mr. W. C. (First Officer)	1	"Carn Marth."
Brown, Alfred John - -	11	"Arafura."
Buchan, James - -	16	"Coppename."
Burton, George - -	1	"British Prince."
Campbell, Archibald - -	13	S.S. "Circassia."
Carpenter, Lieut. Alfred, R.N., F.R.Met.Soc.	11	H.M.S. "Myrmidon."
Cato, W. R. - - -	7	S.S. "Scotia."
Clarke, James - - -	3	S.S. "Olbers."
Cooke, Charles F. - -	3	"Melbourne."
Crotty, J. H. - - -	2	"Evesham Abbey."
Crutchley, William Caius, R.N.R.	8	S.S. "Ruapehu" and S.S. "Kaikoura."
Dart, Leonard C. - -	5	"Alcester."
Davidson, H. - - -	1	S.S. "Oceanic."
Denham, George - -	5	S.S. "Erl King" and S.S. "Ocean King."
Deuchars, William - -	3	S.S. "Jan Mayen."
Donaldson, R. A. - -	2	S.S. "Glenavon."
Dunbar, John Ivor - -	3	S.S. "Arracan."
Dyke, Henry W. - -	5	"Markland."
Dyke, Lieut. in Command H. H., R.N.	1	H.M.S. "Sylvia."
East, Lieut. James H. C., R.N.	5	H.M.S. "Myrmidon."
England, Thomas - -	2	"Jane."
Freeman, Thomas William -	19	S.S. "Bellerophon."
Fullarton, D. - - -	1	"Timaru."
Gadd, C. - - -	1	S.S. "Parramatta."
Graham, W. Vincent - -	1	"Bowfell."
Gray, David - - -	11	S.S. "Eclipse."
Grieve, William M. - -	5	"City of York."

Captain's Name.	Number of "Excellent" Logs.	Ship.
Griffin, E. J.	1	S.S. "Spartan."
Halley, Edward	1	"City of Madras."
Hayward, P. M.	1	S.S. "Dacia."
Holdich, John Peach, R.N.R.	9	"British Envoy."
Holloway, John	2	S.S. "Bombay."
Howard, Lieut. W. Vansittart, R.N.	3	H.M.S. "Flying Fish."
Hughes, W. P.	6	"Laomene."
Hurrell, A. A.	1	"Carn Marth."
Irving, P. J.	1	S.S. "Republic."
Jeffery, Arthur W.	7	S.S. "Teniers."
Jones, S. Griff	5	"Hermine."
Kellett, Arthur	1	S.S. "Calabria."
Kennedy, C. W.	2	S.S. "Germanic."
Kidley, W. H.	4	S.S. "Coptic."
Ladd, Mr. Richard, F.R.A.S., F.R.Met.Soc.	11	S.S. "Scotia."
Lalley, William Nicholson	5	S.S. "Derwent."
Lawson, James	5	S.S. "Minho" and S.S. "Humber."
Leeper, Lieut. A., R.N.	5	H.M.S. "Lark."
Longley, H.	12	S.S. "Mosser."
Lunham, R. D.	8	S.S. "Ceylon."
McDougall, Alexr.	3	"Auckland."
McFee, J. R.	1	"Great Victoria."
Maclear, J. F. L. P., R.N.	10	H.M.S. "Flying Fish."
Mallandaine, Frederick	1	"Imberhorne."
Manning, Henry	8	S.S. "Seine."
Marshall, Frederick	1	"Wiltshire."
Messum, Lieut. S. V. S. S., R.N.	1	H.M.S. "Dart."
Metcalfe, John	8	S.S. "Oceanic."
Miller, A. John	4	"Cannanore."
Milne, W. F.	2	S.S. "Esquimaux."
Moffat, Thomas	1	"Westland."
Moore, Lieut. and Comr. W. U., R.N.	4	H.M.S. "Dart."
Murdoch, Peter	6	"Sierra Estrella."
Murray, Alexander	4	S.S. "Windward."
Nicholson, Malcolm	4	"St. Vincent."
Norman, Francis	3	"Polestar."
Nowell, S.	1	"British Prince."
Oldham, Lieut. in Command C. F., R.N.	6	H.M.S. "Lark."
Olver, William	3	"Clynder."
Pagan, James	2	S.S. "Tenasserim."
Parsell, Henry	7	S.S. "Adriatic."
Parson, Geo. Fry	4	"Earnock."
Pearson, Charles William	24	S.S. "Strathleven."
Peebles, Robert	9	"Tweedsdale."
Potter, Thomas	2	S.S. "Durham."
Prout, John Cawse	3	"Cape St. Vincent."
Randall, William	7	"Dynomene."
Renaut, Charles Henry	14	"Pleione."

Captain's Name.	Number of "Excellent" Logs.	Ship.
Richardson, Sub.-Lieut. Wyndham, R.N.	6	H.M.S. "Sylvia."
Rosseter, William Lawrence -	4	"St. Kilda."
Russell, Charles James -	4	"Candahar."
Savage, Lieut. W. M., R.N. -	2	L.H. Tender "Richmond."
Scott, William - -	15	"Commewyne."
Seymour, J. - - -	3	S.S. "Scotia."
Shaw, Gilbert - - -	5	S.S. "Beta."
Shearer, George - -	7	"Corona."
Simpson, A. - - -	1	S.S. "Australasian."
Simpson, Alexander - -	15	"Traveller."
Smith, J. - - -	1	"Crosshill."
Smith, William Charles -	9	"Thirlmere."
Smith, William Henry, R.N.R.	18	S.S. "Circassian."
Spratley, W. - - -	6	S.S. "Mozart."
Steven, David - - -	3	"Inchkeith."
Stiven, John H. - -	5	"Arethusa."
Strang, Robert - -	2	"Lyttelton."
Tannock, Robert Stewart -	5	"Glencairn."
Thomson, A. S. - -	5	S.S. "Dacia."
Trant, W. H. - - -	1	S.S. "Venetian."
Travers, H. de la Cour -	2	S.S. "Tartar."
Trott, Samuel - - -	3	S.S. "Minia."
Vereker, Capt. Hon. Foley C. P., R.N.	4	H.M.S. "Magpie."
Wait, A. McLean - -	3	S.S. "Spartan."
Walker, Henry - -	4	S.S. "Cephalonia."
Waring, William - -	11	S.S. "Gordon Castle."
Watson, Alexander - -	1	"Elvira."
Wharton, W. J. L., R.N. -	15	H.M.S. "Sylvia."
Wheaton, N. J. - -	1	"Eliza."
White, Elijah - - -	1	"Marathon."
Wight, Henry Potts - -	13	"Oamaru."
Williamson, Lieut. Andrew C., R.N.	2	H.M.S. "Myrmidon."
Wilson, William - -	1	"Horsa."
Youlden, H. - - -	4	"May Hulse."

Names of observers deceased printed in italics.

APPENDIX III.—Ships supplied and Documents returned during the year ending 31st March 1885.

The number of merchant ships supplied with standard instruments and meteorological logs during the above period was 117.

The number of meteorological logs and documents from Foreign Stations received during the same period, and registered in the Office, amounted altogether to 317, of which 190 were returned from ships, and the remainder from land stations, outside the British Isles.

List of Documents received from Land Stations.

Place.	Observer.	No. of Documents.	Nature of Observations.
Abaco (Bahamas) - -	G. L. Nairn, Lightkeeper -	1	"Lighthouse" Register, January to December 1884.
Barbados (Commercial Hall) -	T. L. Ince - - -	2	"Lighthouse" Register, January to December 1884.
„ (Joe's River House) -	R. B. Walcott, M.D., F.R. Met. Soc.	2	„ „ „ „ „ „
Bermuda - - - -	Sergt. J. Green, Medical Staff Corps.	5	Anemograms, February 1884 to February 1885.
Beyrout (Lee Observatory) -	F. Nimr, B.A., and R. H. West.	11	Two observations daily, March 1884 to February 1885.
Breaksea Island (King George's Sound).	W. Lindfield, Lightkeeper -	1	"Lighthouse" Register, July to December 1883.
Cape Juby (North West Africa) -	S. Morris - -	10	Two observations daily, February 1884 to January 1885.
Cape Pembroke (Falkland Islands)	G. K. Broom, Lightkeeper -	2	"Lighthouse" Register, January to December 1884.
Cay Lobos (Bahamas) - -	Byron N. Jones and G. L. Nairn, Lightkeepers.	2	„ „ July 1883 to June 1884.
Cay Sul (Bahamas) - -	T. R. Thompson, Lightkeeper	8	„ „ May to December, 1882; July 1883 to June 1884.
Elopura (N.W. Borneo) - -	D. Mason Fraser - -	1	Monthly temperature and rainfall observations for the quarters ending March to September 1884.

LIST of DOCUMENTS—*continued.*

Place.	Observer.	No. of Documents.	Nature of Observations.
Famagusta (Cyprus) - -	A. H. Moghabghab and S. Photinos.	6	Two observations daily, November 1882 to April 1883.
Gibraltar - - - -	Sergt. A. Rand and Lance-Corpl. T. W. Jent, Med. Staff Corps.	12	„ „ „ March 1884 to February 1885.
Great Basses - - -	Lightkeepers - -	3	Eight observations daily, May and June, and October 1884 to January 1885.
Heligoland - - -	Lightkeepers - -	13	„ „ „ February 1884 to February 1885.
Inagua (Bahamas) - -	N. H. E. Garner, Lightkeeper	2	"Lighthouse" Register, January to December 1884.
Kilwa, Kivinji - - -	Lieut. C. S. Smith, R.N., H.M. Vice-Consul.	3	Two observations daily, May to July 1884, with barometer diagrams for the same period.
Kudat (N.W. Borneo) - -	J. J. L. Wheatley - -	1	Daily temperature and rainfall observations, October to December 1883, and abstract for the year.
Kyrenia (Cyprus) - -	E. Joannides - -	6	Two observations daily, November 1882 to April 1883.
Larnaca (Cyprus) - -	A. Tsepis - - -	6	„ „ „ „ „ „
Limassol (Cyprus) - -	Luigi Béraud - -	6	„ „ „ „ „ „
Little Basses - -	Lightkeepers - -	3	Eight observations daily, May and June, and October 1884 to January 1885.
Nicosia (Cyprus) - -	A. Kyriakides - -	6	Two observations daily, November 1882 to April 1883.
Norfolk Island - - -	T. Rossiter - - -	2	„ „ „ October 1883 to February 1884.
Papho (Cyprus) - - -	A. H. Moghabghab and E. A. Malliotis.	6	„ „ „ November 1882 to April 1883.
Perim - - - -	Robert Stopford - -	2	Three observations daily, January 5, to May 23, 1884; two observations daily, August and September 1884.
São Paulo (Brazil) - -	Late H. B. Joyner, F.R.G.S., F.R.Met.Soc.	1	Two observations daily, December 1883.
Sombrero - - -	J. A. Richardson, Lightkeeper	2	"Lighthouse" Register, December 1883 to November 1884.
Suva (Fiji) - - -	J. D. W. Vaughan - -	8	One observation daily, May 1883 to November 1884.

List of Documents received from Ships.

Captain's Name.	Ship.	Tons.	Owners.	Voyage and Year.	Months of Register.
[1] Alderton, T.	S.S. Australia	2,137	P. & O. Steam Navigation Co., London.	To and from Calcutta, viâ Suez, 1884	3
[2] Aldrich, Pelham, R.N.	Sylvia	1,050	H.M.S.	At Cape of Good Hope, 1884	4
[2] " " "	"	"	"	In Simon's Bay, 1884	12 days.
[2] " " "	"	"	"	Off East Coast of Africa, 1884–85	4
Balderston, R. J.	Belfast	1,865	R. Brocklebank, Liverpool	To and from Calcutta, 1884	7
[3] Barlow, A. E.	S.S. Parramatta	4,759	P. & O. Steam Navigation Co., London.	To Sydney, Bombay, and home, viâ Suez, 1884	4
Barlow, B. J., R.N.R.	S.S. Amarapoora	2,464	British and Burmese Steam Nav. Co., Lim., Glasgow.	To and from Rangoon, viâ Suez, 1884	3
Becket, Alexander	Amana	1,299	J. Smith, Glasgow	To Sydney, Wilmington (Cal.), Astoria, and home, 1883–84	11
[4] Berridge, Henry	Superb	1,451	H. Green, Blackwall	To Melbourne, and from Newcastle (N.S.W.) to San Francisco and home, 1883–84	9
[5] Black, John	S.S. Explorer	1,298	The Charente S.S. Co., Lim., Liverpool.	To and from New Orleans, 1884	2
Blake, E. J.	Tilkhurst	1,527	W. R. Price, London	To Algoa Bay, Newcastle (N.S.W.), San Francisco, and home, 1883–85	12
Bolton, S. H.	S.S. Tyne Queen	1,264	J. W. Smith, Hull	Three voyages to and from Spanish Ports, 1884	3
" "	" "	"	" "	One voyage to and from Harnas (Sweden), three to and from Drontheim, 1884–85	2
Bouchette, F. B.	S.S. Montreal	3,308	Mississippi & Dominion S.S. Co., Lim., Liverpool.	Five voyages to and from Quebec, 1884	3
Bowen, Albert	Barque Chilian	601	J. Donaldson, Glasgow	To and from Valparaiso, 1883–84	7
Brown, A. J.	Barque Arafura	540	J. R. Anderson, London	To Newcastle (N.S.W.), Valparaiso, and home, 1883–85	10

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage and Year.	Months of Register.
Brown, E. - -	Barque Moorhill -	484	E. Brown, Liverpool - -	To Buenos Ayres, Pernambuco, Barbadoes, Galveston, and home, 1884–85 - - - - -	6
Buchan, James -	Barque Coppename -	316	J. C. Pearson, Glasgow - -	To and from Surinam, 1883–84 -	2
" " -	" -	"	" " - -	" " 1884 - -	3
Burton, George -	S.S. British Prince -	2,548	British Shipowners Co., Lim., Liverpool.	Four voyages to and from Philadelphia, 1884 - - - -	3
[6] Campbell, Archibald	S.S. Circassia - -	4,272	The Barrow Steam Ship Co., London.	Five voyages to and from New York, 1884 - - - - -	4
[7] Carpenter, A., R.N., F.R.Met.Soc.	Myrmidon - -	877	H.M.S. - - - -	To Suakim, viâ Suez, and surveying off the coast, 1884 - - -	4
[8] " " -	" - -	"	" - - - -	Surveying in Red Sea, and at Suez, 1884 - - - -	5
[9] Cato, W. R. -	S.S. Scotia - -	4,667	Telegraphic Construction and Maintenance Co., Lim., London.	One voyage to and from St. Vincent; one to and from Bilbao, 1884 -	2
Chaddock, G. A. -	Schooner Maud -	30	E. T. Chaddock, Liverpool -	To Zanzibar, viâ Suez, and Natal, 1883–84 - - - - -	4
Clarke, James -	S.S. Olbers - -	2,168	Liverpool, Brazil, and River Plate Steam Navigation Co., Liverpool.	One voyage home from New York; two voyages to Madeira, Rio Janeiro, Bahia, New York, and home, 1884 -	5
" " -	" " - -	"	" " " -	Two voyages to Lisbon, Bahia, Rio Janeiro, New York, and home, 1884–85 - - - - -	4
Cooke, C. F. -	Melbourne - -	1,857	H. Green, Blackwall - -	To and from Melbourne, 1884-85 -	6
Crotty, F. H. -	Evesham Abbey -	1,613	J. Poole, Liverpool - -	To and from Calcutta, 1884–85 -	7
Crowell, S. O. -	S.S. Alpha - -	653	W. Cunard, London - -	Between Halifax and Jamaica, viâ Bermuda, 1884 - - -	3
Crowley, C. - -	Barque Lucia - -	640	J. Killick, London - -	To Hong-Kong, Formosa, Yokohama, Newchwang, Hong-Kong, 1883–84 -	7

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage and Year.	Months of Register.
[10] Crutchley, W. C., R.N.R.	S.S. Kaikoura -	2,885	New Zealand Shipping Co., Christchurch, N.Z.	To and from Lyttelton, via Suez, 1884–85 - - - - -	8
[11] „ „ -	S.S. Ruapehu - -	2,655	„ „ „ -	To Hobart Town, Wellington, Rio Janeiro, and home, 1884 - -	3
Lart, L. C. - -	Alcester - - -	1,597	R. C. Haws, Liverpool - -	To and from Rangoon, 1883–84 -	8
Davison, H. -	S.S. Oceanic - -	2,440	Oceanic Steam Navigation Co., Lim., Liverpool.	Trading between Hong-Kong and San Francisco, viâ Yokohama, 1883–84 -	9
Denham, George -	S.S. Erl King - -	2,193	W. Ross, Glasgow - -	To and from New Orleans, 1883–84 -	2
[12] „ „ -	S.S. Ocean King -	1,606	„ „ - -	Two voyages to and from Montreal; one to Montreal, Alexandria, New York, and home, 1884 - -	4
[12] „ „ -	-	„	„ „ - -	To and from New York, 1885 - -	1
Deuchars, W. -	S.S. Jan Mayen -	469	The Dundee Polar Fishing Co., Dundee.	To and from Greenland, and to and from Davis Straits, 1884 - -	7
Donaldson, R. A. -	S.S. Glenavon -	2,985	J. McGregor, London - -	To Singapore (viâ Suez), Hong-Kong, Shanghai, Yokohama, Gibraltar (viâ Suez), New York, and home, 1884 -	4
„ „ -	„ -	„	„ „ - -	To and from China, viâ Suez, 1884–85	4
[13] Dulling, George -	S.S. Port Phillip -	1,782	Anglo-Australasian Steam Navigation Co., London.	To Melbourne, viâ Cape Good Hope, and home, viâ Suez Canal, 1884–85	4
Dunbar, J. I. -	S.S. Arracan - -	1,856	British and Burmese Steam Navigation Co., Glasgow.	To and from Rangoon, viâ Suez, 1884	8
„ „ -	„ - -	„	„ „ „ -	„ „ „ „ -	8
[14] Duncan, Robert -	S.S. Garth Castle -	2,381	Sir T. Brassey, Westminster -	To Table Bay, 1884 - - -	1
Dutton, J. E. -	S.S. Sardinian -	2,577	R. G. Allan, Liverpool - -	One voyage to and from Portland; one to and from Baltimore, 1884 - -	2

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage and Year.	Months of Register.
Dyke, H. H., R.N., Lieut. in Command.	Sylvia - -	1,050	H.M.S. - - - -	From Monte Video to Simon's Bay, 1884 - - -	2
Dyke, H. W. -	Barque Markland -	920	W. H. De Veber, St. John's, N.B.	To Buenos Ayres, Valparaiso, Mauritius, Galle, Bangkok, and home, 1883–85 - - - -	14
England, Thomas -	Barque Jane - -	636	P. Sutherland, Liverpool - -	To Apalachicola, and home, 1884 -	5
" " -	" - -	"	" " - -	To St. Vincent, New Orleans, and home, 1884–85 - - -	3
[15] Freeman, T. W. -	S.S. Bellerophon -	1,397	Oceanic Steam Navigation Co., Liverpool.	To and from China, viâ Suez, 1884 -	3
[16] " " -	" -	"	" " " -	" " " " -	4
Fullarton, D. -	Timaru - -	1,306	Shaw, Savill, and Albion Co., Lim., London.	To Otago, Oregon, and home, 1884–85	8
[3] Gadd, C. - -	S.S. Parramatta -	2,684	P. & O. Steam Navigation Co., London.	To and from Sydney, viâ Suez, 1884–85	4
[16] Graham, W. Vincent	Barque Bowfell -	1,002	R. Brocklebank, Liverpool -	To and from Manila, 1883–84 - -	8
Gray, David -	S.S. Eclipse - -	435	D. Gray, Peterhead -	To and from Greenland, 1884 - -	5
Green, Frederick -	Barquentine Zea -	201	J. Adamson, Sunderland - -	To Constantinople, 1884 - -	2
Grey, Charles, R.N.R.	Mac Millan - -	1,450	J. McMillan, Jun., Dumbarton -	To Calcutta, 1883–84 - - -	3
Greive, W. M. -	City of York - -	1,195	G. Smith, Glasgow - -	To and from Astoria, 1884–85 - -	8
[17] Griffin, E. - -	S.S. Spartan - -	2,223	Union S.S. Co., Lim., Southampton.	To and from Cape Town, 1884 -	2
Grose, Henry -	Melmerby - -	1,510	A. Cassels, Liverpool - -	To and from Quebec, 1884 - -	2
Halley, Edward -	City of Madras -	1,577	G. Smith, Glasgow - -	To and from Rangoon, 1883–84 -	7
[15] Hannah, Henry -	S.S. Irrawaddy -	1,623	British and Burmese Steam Navigation Co., Glasgow.	From Gibraltar to Rangoon, and back, viâ Suez, 1884 - - - -	2
Harrison, H. I. N. -	S.S. Asiatic - -	1,557	Union S.S. Co., Lim., London -	To Port Elizabeth, 1884 - -	1
[18] Hayward, P. M. -	S.S. Dacia - -	1,473	India Rubber and Telegraph Works Co., London.	From Cadiz to the Canary Islands and home, 1883–84 - - - -	5

LIST of DOCUMENTS, &c.—*continued.*

	Captain's Name.	Ship.	Tons.	Owners.	Voyage and Year.	Months of Register.
	Hird, William -	Marlborough - -	1,124	J. Lealie, London - -	From Lyttelton, 1884 - - -	3
	„ „ -	Taranaki - -	1,130	„ „ - -	To Lyttelton, 1883 - - -	3
	Holdich, J. P., R.N.R.	British Envoy - -	1,265	J. Coupland, Leicester - -	To and from Melbourne, 1883-84 -	6
19	Holloway, John -	S.S. Bombay - -	2,044	R. S. Donkin, North Shields -	To New Zealand, viâ Cape of Good Hope, Rio Janeiro, and home, 1883–84 -	4
19	„ „ -	„ - -	„	„ „ -	To and from New Zealand, viâ Cape of Good Hope, 1884 - - -	4
	Hughes, W. P. -	Laomene - -	1,746	D. Fernie, Liverpool - -	To Mauritius, Wallaroo, and home, 1883–84 - - - -	8
20	Hurrell, A. A. -	Carn Marth - -	1,174	E. Handcock, Cardiff - -	To Malta, New York, and home, and to and from Wilmington, 1884–85 -	8
21	Irving, P. J. -	S.S. Republic - -	2,187	Oceanic Steam Navigation Co., Liverpool.	Five voyages to and from New York, 1884 - - - - -	3
	Jeffery, A. W., F.R. Met. Soc.	S.S. Teniers - -	- - -	- - - - -	From Antwerp to Buenos Ayres, Monto Video, Rio Janeiro, and home, 1884 - - - -	3
	„ „ -	„ - -	- - -	- - - - -	To and from Monte Video, 1884 -	2
22	Jones, S. G.- -	Barque Hermine -	538	T. H. Jackson, Liverpool -	To Rosario, Lota, Ilico, Buchupureo, and home, 1883–84 - - -	9
	Judd, S. G.- -	Barque Spirit of the Dawn.	692	J. Bell, Liverpool - -	To Brisbane, Portland (Oregon), and home, 1883–84 - - -	9
22	Kellett, Arthur -	S.S. Calabria - -	2,031	Telegraph Construction and Maintenance Co., London.	To and from Singapore, viâ Suez, 1883–84 - - - - -	4
23	„ „ -	„ - -	„	„ „ „	To St. Vincent, Brazil, St. Vincent, and home, 1884 - - - -	2
	Kennedy, C. W. -	S.S. Germanic -	3,150	Oceanic Steam Navigation Co., Liverpool.	Five voyages to and from New York, 1884–85 - - - -	8
	Kidley, W. H. -	S.S. Coptic - -	2,789	„ „ „	Trading between Hong Kong and San Francisco, viâ Yokohama, 1882 -	4

LIST of DOCUMENTS, &c.—*continued.*

	Captain's Name.	Ship.	Tons.	Owners.	Voyage and Year.	Months of Register.
	Kidley, W. H.	S.S. Coptic	2,789	Oceanic Steam Navigation Co., Liverpool.	To New Zealand, viâ Cape of Good Hope, Rio Janeiro, and home, 1884	3
	King, J. W.	Fearnought	1,293	The Merchants Trading Co., Liverpool.	To Zanzibar, Galle, Rangoon, and home, 1883–84	8
	Lailey, W. N.	S.S. Derwent	986	Mercantile S. S. Co., Lim., London.	Two voyages to and from Cronstadt; one to Brindisi, Girgenti, and home, 1884	3
	Lawson, James	S.S. Humber	1,528	Royal Mail Steam Packet Co., London.	To Barbadoes, Grenada (W. I.), and Havre, 1883	1
	" "	"	"	" " "	To Brazil, River Plate, and home, 1883	3
	Leslie, John	Invercauld	1,247	R. Connon, Aberdeen	To Cape Town, Calcutta, Mauritius, Madras, Batavia, and home, 1883–84	8
	Lindsay, H. K.	Eaton Hall	1,779	S. Williamson, Liverpool	To Melbourne, Newcastle (N.S.W.), San Francisco, and home, 1883–84	8
[15]	Longley, H.	S.S. Mosser	1,323	J. H. Bushby, London	To China and Japan, viâ Suez, thence to New York, viâ Suez, and home, 1883–84	6
[25]	Lunham, R. D.	S.S. Ceylon	2,149	J. L. Clark, London	One voyage to and from Mediterranean ports, one to and from Port Said, one to and from Funchal, one to and from Iceland, one to Copenhagen, 1884	4
	McClure, William	Iron Cross	1,508	D. Fernie, Liverpool	To and from Java, 1883–84	7
	McDougall, Alexander.	Auckland	1,245	The Albion Shipping Co., Lim., Glasgow.	To Wellington, Newcastle (N.S.W.), Adelaide, and home, 1884–85	7
	McFee, J. R.	Great Victoria	2,268	R. H. Dixon, Liverpool	To and from San Francisco, 1883–84	8
[26]	Maclear, J. F. L. P., R.N.	Flying Fish	940	H.M.S.	At China station, 1884	4
[26]	" "	"	"	"	In China and Japan Seas, 1884	4
[26]	" "	"	"	"	" " " "	4

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage and Year.	Months of Register.
McMillan, John -	Canterbury - -	1,245	Shaw, Savill, and Albion Co., Lim., London.	To and from Otago, 1883–84 - -	6
Malet, J. H. -	S.S. Marengo - -	1,828	A. Wilson, Hull - - -	To and from New York, 1884 - -	1
Mallandaine, Frederick.	Imberhorne - -	1,997	Imberhorne Ship Co., London -	To Sydney, San Francisco, and home, 1883–84 - - - -	10
[27] Manning, Henry -	S.S. Seine - -	3,579	Telegraph Construction and Maintenance Co., Lim., London.	To Singapore, viâ Suez, Batavia, Port Darwin, Singapore, and home viâ Suez, 1883–84 - - -	4
[27] „ „ -	„ - -	„	„ „ „	To and from Singapore, viâ Suez, 1884	3
Marshall, Frederick -	Wiltshire - -	1,461	G. Marshall, London - -	To and from Chittagong, 1884–85 -	7
Metcalfe, J. - -	S.S. Oceanic - -	2,440	Oceanic Steam Navigation Co., Lim., Liverpool.	Trading between Hong-Kong and San Francisco, viâ Yokohama, 1882–83 -	3
Miller, A. J. -	Cannanore - -	1,599	W. H. De Wolf, Liverpool -	To Rio Janeiro, Chittagong, and New York, 1883–84 - - -	8
[28] Miller, A. T., R.N. -	Conway - -	—	Training Ship - - -	Off Birkenhead, 1884 - - -	4
Milne, W. F. -	S.S. Esquimaux -	466	Dundee Whale and Seal Fishing Co., Dundee.	To St. John's, Davis Straits, and home, 1884 - - - -	7
Moffat, Thomas -	Westland - -	1,116	Shaw, Savill, and Albion Co., Lim., London.	To and from Wellington, 1883–84 -	6
[29] Moore, W. U., R.N., Lieut. and Comr.	Dart - - -	470	H.M.S. - - - -	At Hobart Town, 1883–84 - -	3
Muir, J. - -	Invercargill - -	1,246	Shaw, Savill, and Albion Co., Lim., London.	To and from New Zealand, 1883–84 -	6
Murdoch, Henry -	Penthesilea - -	1,668	W. D. Reid, Liverpool - -	To Bombay, Rangoon, and home, 1883–84 - - - -	8
Murdoch, Peter -	Sierra Estrella -	1,436	A. M. Anderson, Liverpool -	To Melbourne, Newcastle (N.S.W.), San Francisco, and home, 1883–84 -	10
„ „ -	„ - -	„	„ „ -	To and from Chittagong, 1884–85 -	7

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage and Year.	Months of Register.
Murray, Alexander -	S.S Windward -	321	W. Baxter, Peterhead - -	To and from Greenland, 1884 - -	
New, G. - -	S.S. Annie - -	1,247	J. Gray, Whitby - - -	One voyage to St. Vincent and home, and one to New York and home, 1884 - - - -	3
[16] Nicholson, Malcolm -	Barque St. Vincent -	891	T. L. Devitt, London - -	To and from Adelaide, 1884–85 -	6
Norman, Francis -	Barque Polestar -	625	J. Lyne, Liverpool - -	To Valparaiso, and home from Talcahuano, 1883–84 - - -	5
Norris, W. H. -	Barque Dilbhur -	1,281	G. Lidgett, London - -	To Rio Janeiro, Valparaiso, Mauritius, Adelaide, and towards home, 1883–84	8
Nowell, S. - -	S.S. British Prince -	2,548	British Shipowners' Co., Lim., Liverpool.	To and from Philadelphia, 1884 -	1
[30] Oldham, C. F., R.N., Lieut. in Command.	H.M.S. Lark - -	—	H.M. Schooner - - -	At Auckland, N.Z., 1883–84 - -	4
[30] " " -	" - -	—	" " - - -	" " 1884 - -	4
[30] " " -	" - -	—	" " - - -	On Australian station, 1884 - -	4
[30] " " -	" - -	—	" " - - -	" " - -	2
Olver, William -	Barque Clynder -	1,117	R. Thorn, Glasgow - -	To Sydney, Newcastle (N.S.W.), Lyttleton, and towards home, 1883–84 -	6
Owen, Henry -	S.S. Arab - -	2,044	Union S.S. Co., London - -	To and from Baltimore, viâ Bermuda, 1884 - - - -	2
Pagan, James -	S.S. Tenasserim -	1,755	British and Burmese Steam Navigation Co., Lim., Glasgow.	To and from Rangoon, via Suez, 1884 -	3
[31] Park, J. B. - -	S.S. Potosi - -	2,704	Pacific Steam Nav. Co., Liverpool	To and from Sydney, viâ Suez, 1884 -	3
[32] Parker, E. J. -	Halcione - -	843	W. Savill, London - -	To Wellington, 1883–84 - -	4
[33] Parsell, H. - -	S.S. Adriatic - -	2,458	Oceanic Steam Navigation Co., Liverpool.	Six voyages to, and five from, New York, 1884–85 - - - -	4
Parson, G. F. -	Earnock - -	1,198	W. Fraser, London - -	To and from Adelaide, 1883–84 -	7

LIST of DOCUMENTS &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage and Year.	Months of Register.
[34] Pearson, C. W.	S.S. Strathleven	2,436	W. Burrell, Glasgow	From Gibraltar to Yokohama and New York, via Suez, thence to Savannah, and home, 1883–84	5
[34] " "	"	"	" "	From Suez to Yokohama, Shanghai, and New York, via Suez, 1884–85	4
Peattie, R. D.	Barque Brodick Bay	753	J. S. Hatfield, Liverpool	To and from New Zealand, 1884	7
Peebles, Robert	Barque Tweedsdale	1,403	J. Roxburgh, Glasgow	To and from Calcutta, 1884	7
Peters, James	S.S. Gloucester	1,804	Great Western Steamship Co., Lim., Bristol.	One voyage towards Baltimore. One to and from New York, 1883–84	2
Potter, Thomas	S.S. Durham	1,466	W. S. Bailey, Hull	Trading between Hull, Cronstadt, Reval, and Rotterdam, 1883–85	3
Prout, J. C.	Cape St. Vincent	1,422	A. P. Lyle, Greenock	To Cape Town, Java, and home, 1883–84	8
Purdie, Robert	Barque Savanetta	324	G. M. Turnbull, Glasgow	To Trinidad, New York, Trinidad, and home, 1883–84	7
Randall, William	Dynomene	1,900	D. Fernie, Liverpool	To Calcutta and New York, 1883–84	8
Renaut, C. H.	Pleione	1,092	The Shaw, Savill, and Albion Co., Lim., London.	To and from Wellington, 1883–84	7
Roberts, A. F.	Trevelyan	1,042	Shaw, Savill, and Albion Co., Lim., London.	Home from Port Chalmers, 1884	3
Rogers, J. T., R.N.R.	S.S. Lepanto	1,871	A. Wilson, Hull	To and from New York, 1884	2
Rosseter, W. L.	Barque St. Kilda	865	A. T. Parker, Liverpool	To and from Demerara, 1884	3
" "	" "	"	" "	" " "	3
Russell, C. J.	Candahar	1,418	R. Brocklebank, Liverpool	To and from Calcutta, 1883–84	8
Sanderson, J.	Collingrove	861	A. L. Elder, London	To and from Adelaide, 1883–84	7
Sargent, A. H.	Barque Glendora	774	Shaw, Savill, and Albion Co., Lim., London.	Home from Canterbury, N. Z., 1884	3
[35] Savage, Lieut. W. M., R.N.	L. H. Tender Richmond	183	Board of Trade, London	At the Bahamas, 1883–84	13
[36] " "	" "	"	" "	" " 1884	4

LIST OF DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage and Year.	Months of Registor.
Savage, Lieut. W. M., R.N.	L. H. Tender Richmond	183	Board of Trade, London - -	At the Bahamas, 1884–85 - -	4
Scott, William -	Barque Commewyne -	315	J. Grierson, Glasgow - -	To and from Surinam, 1884 - -	3
„ „ -	„ „ -	„	„ „ - -	„ „ 1884–85 -	3
[9] Seymour, J. -	S.S. Scotia - -	2,931	Telegraph Construction and Maintenance Co., London.	To and from Pernambuco. 1884 -	2
Shaw, Gilbert -	S.S. Beta - -	1,087	W. Cunard, London - -	Retween Halifax and Jamaica, viâ Bermuda, 1884 - - -	1
„ „ -	„ - -	„	„ „ - -	„ „ „ „	4
Shearer, George -	Barque Corona -	1,210	W. Stephen, Dundee - -	To Newcastle (N.S.W.), Iquique, and Hamburg, 1883–85 - - -	10
Simpson, A. -	S.S. Australasian -	2,343	W. Henderson, Aberdeen -	To Sydney, viâ Cape of Good Hope, and home, viâ Suez, 1884 - -	8
Simpson, Alexander	Schooner Traveller -	196	A. Simpson, Peterhead - -	To Ivigtut, Philadelphia, Ivigtut, Philadelphia, and Esbjerg (Jutland), 1884	7
Smith, J. - -	Barque Cross Hill -	1,019	J. Hayton, Liverpool - -	To Yokohama, Kobé, New York, and home, 1883–84 - - -	14
[28] Smith, J. H., R.N.R.	Worcester - -	—	Training Ship - - -	Off Greenhithe, 1883–84 - -	4
[28] „ „	„ - -	—	„ - - -	„ „ 1884 - - -	3
Smith, W. C. -	Thirlmere - -	1,711	J. Fisher, London - -	To Sydney, San Francisco, Pernambuco, and home, 1883–84 - - -	10
[37] Smith, W. H., R.N.R.	S.S. Circassian -	2,356	R. G. Allan, Liverpool - -	Two voyages to and from Quebec, three to and from Halifax, 1883–84 -	4
Spratly, W. - -	S.S. Mozart - -	1,304	Liverpool, Brazil, and River Plate Steam Nav. Co., Liverpool.	One voyage to Lisbon, Bahia, Rio Janeiro, Bahia, and home; and one to Monte Video, Santos, Bahia, and home, 1883–84 - - -	4

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage and Year	Months of Register.
Spratly, W.	S.S. Mozart	1,304	Liverpool, Brazil, and River Plate Steam Nav. Co., Liverpool.	One voyage to and from Monte Video; one home from Monte Video, 1884–85	4
Steven, David	Barque Inch Keith	1,238	A. Russell, Glasgow	To and from Calcutta, 1883–84	8
Stewart, J. R.	S.S. Ayreshire	871	J. Turnbull, Glasgow	Glasgow to Naples, Porman, Philadelphia, Havanna (Cuba), Sagua la Grande, New York, Cardenas (Cuba), New York, Jamaica, Halifax, St. John's, and home, 1883–84	5
Stinson, Alfred	Barque Julia H.	585	R. C. Haws, St. John's, N.B.	To and from Jamaica, 1883–84	4
Stiven, J. H.	Arethusa	1,272	J. Hamilton, Liverpool	To Bombay, Calcutta, Akyab, Queenstown, and Antwerp, 1883–84	10
Strang, Robert	Lyttelton	1,111	Shaw, Savill, and Albion Co., Lim., London.	To and from Otago, 1884	6
Tannock, R. Stewart	Glencairn	1,564	A. Allen, Glasgow	To and from Chittagong, 1883–84	7
[4] Thompson, A. S.	S.S. International	1,004	India Rubber, &c. and Telegraph Works Co., London.	To Teneriffe, 1884	2
[28] Tomlin, P. S.	S.S. Ballaarat	4,752	P. & O. Steam Navigation Co., London.	Two voyages to and from Melbourne, viâ Suez, 1883–84	6
" "	"	"	" " "	To Melbourne and back to Malta, viâ Suez, 1884	2
[28] " "	"	"	" " "	To and from Melbourne, viâ Suez, 1884–85	8
Trant, W. H.	S.S. Venetian	2,733	S.S. Venetian Co., Liverpool	Six voyages to, and five from, Boston, 1884	4
[39] Travers, H. de la Cour.	S.S. Tartar	2,755	Union S.S. Co., Lim., Southampton	Two voyages to and from Cape Town, &c., 1884	3
[39] " "	"	"	" " "	Two voyages to and from Cape Town, &c., 1884	3

LIST of DOCUMENTS, &c.—*continued.*

	Captain's Name.	Ship.	Tons.	Owners.	Voyage and Year.	Months of Register.
40	Trott, Samuel -	S.S. Minia - -	1,350	Anglo-American Telegraph Co., London.	To Berehaven, Cardiff, Brest, Falmouth, and Halifax, 1884 - - -	4
40	„ „ -	„ - -	„	„ „ „ -	In Halifax Harbour and off coast of Newfoundland, 1884 - -	4
9	„ „ -	„ - -	„	„ „ „ -	At Halifax and in North Atlantic, 1884–85 - - - - -	4
41	Vereker, The Hon. F. C. P., R.N.	Magpie - -	774	H.M.S. - - - -	Surveying in Strait of Malacca, and from Batavia to Aden, Seychelles, and Aden, 1884 - - -	4
41	„ „ -	„ - -	„	„ - - - -	Home from Seychelles, viâ Suez 1884 -	2
17	Wait, A. McLæan -	S.S. Spartan - -	2,228	Union S.S. Co., Lim., Southampton	To and from Cape Town, 1884 -	2
17	„ „ -	„ - -	„	„ „ „ -	To and from Cape Town, &c., 1884 -	2
	Walker, Henry -	S.S. Cephalonia -	3,490	Cunard S.S. Co., Lim., Liverpool	Three voyages to and from New York, two to and from Boston, 1884 -	4
	„ „ -	„ „ -	„	„ „ „ -	Five voyages to and from Boston, 1884–85 - - - - -	4
42	Waring, William -	S.S. Gordon Castle -	2,031	T. Skinner, London - -	To China, viâ Suez, Australia, New Zealand, Sydney, China, Japan, China, New York, viâ Suez, and home, 1883–84 - - -	8
15	Warren, W. H. C. -	Barque Bedfordshire -	1,155	W. Hope, Liverpool - -	To Rio Janeiro, Akyab, Rangoon, and towards home, 1883–84 - -	8
	Watson, Alexander -	Barque Elvira -	464	H. F. Watt, Wavertree, Liverpool	To Imbituba, Pernambuco, New Orleans, and home, 1883–84 - - -	6
	Wharton, W. J. L., R.N.	Sylvia - -	1,050	H.M.S. - - - -	In Rio de la Plata and Straits of Magellan, 1882–84 - - -	18
2	„ „ -	„ - -	„	„ - - - -	In Straits of Magellan and at Monte Video, 1884 - - - -	2

List of Documents, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage and Year.	Months of Register.
Wheaton, N. J. -	Barquentine Eliza -	299	J. H. Goodyear, Liverpool -	To Imbituba (Brazil), Pernambuco, Barbadoes, St. Vincent, and home, 1884 - - - - -	4
White, Elijah -	Marathon - -	1,471	J. Nevins, St. John's, N.B. -	To Singapore, Valparaiso, Huanillos, and home, 1883–84 - - -	11
Wight, H. P. -	Oamaru - -	1,306	Albion Shipping Co., Lim., Glasgow.	To and from Lyttelton, 1883–84 -	6
[43] Williams, Henry -	Argomene - -	1,662	D. Fernie, Liverpool - -	To Mauritius, Chittagong, and home, 1884 - - - - -	8
Wilson, James -	Barque Clan Ferguson	799	T. Dunlop, Glasgow - -	To Brisbane, Valparaiso, Astoria, and home, 1883–84 - - -	11
Wilson, William -	Barque Horsa - -	1,128	Star Nav. Co., Liverpool - -	To and from Java, 1883–84 - -	8
Youlden, H. -	Barque May Hulse -	463	J. Ransom, Southampton -	To Buenos Ayres, Valparaiso, and home, 1883–84 - - -	7

In cases distinguished by marginal numbers the Meteorological Registers were kept chiefly by Officers, as follows:—

[1] Kept by P. H. Going, 4th Officer.
[2] Kept by Lieutenant Wyndham Richardson, R.N.
[3] Kept by G. Douglas Saunder, 3rd Officer.
[4] Kept by D. Wilson Barker, F.R.Met.Soc., Chief Officer.
[5] Kept by J. W. Jinks, 3rd Mate.
[6] Kept by 3rd Officer.
[7] Kept by Lieutenant A. C. Williamson, R.N.
[8] Kept by Lieutenant A. C. Williamson, R.N., and James H. C. East, R.N.
[9] Kept by Richard Ladd, F.R.A.S., F.R.Met.Soc.
[10] Kept by H. W. Bennett.
[11] Kept by J. C. Westall, 4th Officer.
[12] Kept by J. O. Toole, 2nd Officer.
[13] Kept by Osborn W. Read.
[14] Kept by B. C. Wainwright, F.R.Met.Soc.
[15] Kept by Officers.
[16] Assisted by Officers.
[17] Kept by F. Forbes, 4th Officer.
[18] Kept by Anthony Standidge Thomson.
[19] Assisted by Walter Hodgson, 2nd Officer.
[20] Kept by W. C. Boynes, 1st Officer.
[21] Kept by George James.
[22] Assisted by Messrs. Calvert and Cooper.
[23] Kept by R. C. Keys, 2nd Officer.
[24] Kept by C. Lancaster.
[25] Kept by C. L. Hudson, F.R.Met.Soc.
[26] Kept by Lieutenant W. Vansittart Howard, R.N.
[27] Kept by William W. Inglis, 2nd Officer.
[28] Kept by the Boys.
[29] Kept by Lieutenant Stuart V. S. C. Messum, R.N.
[30] Kept by Lieutenant A. Leeper R.N.
[31] Kept by R. Routh, 3rd Officer.
[32] Kept by Alfred H. Sargeant, Chief Officer.
[33] Kept by R. Ward.
[34] Assisted by A. S. Robertson and E. F. Collard, 2nd Officers.
[35] Kept by Henry King Sturdee, Chief Officer.
[36] Kept by Henry King Sturdee and S. A. Dillett.
[37] Kept by Messrs. Caine & Griffith, 3rd & 4th Officers.
[38] Kept by S. de B. Lockyer, 2nd Officer.
[39] Kept by G. C. Gordon, 2nd Officer.
[40] Kept by W. R. Lugar.
[41] Kept by Lieutenant Andrew Balfour, R.N.
[42] Assisted by W. A. Holland, Chief Officer, and A. Le Huany, 3rd Officer.
[43] Kept by A. W. Lister.

APPENDIX IV.

INSTRUMENTS supplied, &c. to the Royal Navy.

Per Account.	Barometers.	Aneroids.	Thermometers.				Hydrometers.
			Ordinary.	Max.	Min.	Screens.	
April 1st, 1884, afloat	173	366	1,068	142	127	100	119
Issued since	52	80	256	44	37	14	62
	225	446	1,324	186	164	114	181
Returned since	41	69	227	22	29	6	55
April 1st, 1885, afloat	184	377	1,097	164	135	108	126

INSTRUMENTS supplied, &c. for use at Naval Stations.

April 1st, 1884, in use	74	114	250	19	26	5	16
Issued since	3	5	41	3	9	1	—
	77	119	291	22	35	6	16
Returned since	3	6	36	1	2	1	—
April 1st, 1885, in use	74	113	255	21	33	5	16

DISPOSITION of ADMIRALTY INSTRUMENTS on April 1st, 1885.

Afloat in Royal Navy	184	377	1,097	164	135	108	126
In use at stations	74	118	255	21	33	5	16
In store at M.O.	101	72	62	57	77	12	69
„ Chatham	7	5	32	6	5	3	—
„ Sheerness	6	10	56	10	9	2	9
„ Portsmouth	5	6	13	8	5	6	27
„ Devonport	4	5	13	—	8	5	28
„ Queenstown	3	3	1	1	1	—	8
„ Gibraltar	1	4	2	—	—	—	4
„ Malta	6	8	19	5	5	1	18
„ Halifax	6	11	29	6	6	—	12
„ Bermuda	3	6	41	—	2	—	15
„ Jamaica	3	2	12	2	2	—	—
„ Cape of Good Hope	7	9	49	6	6	—	31
„ Trincomalee	—	4	27	4	4	—	—
„ Hong Kong	15	6	31	4	8	2	10
„ Coquimbo	—	7	3	1	2	—	23
„ Sydney	1	5	46	—	1	—	—
„ Esquimalt	6	4	10	2	2	—	—
Total, April 1st, 1885	432	657	1,798	297	311	144	396
Lost, &c. since April 1st, 1884	—	8	158	4	8	5	8
Under repair	7	13	—	—	—	—	—

APPENDIX V.

INSTRUMENTS supplied, &c. to Mercantile Marine.

Per Account.	Barometers.	Compasses.	Thermometers.				Hydrometers.
			Ordinary.	Max.	Min.	Screens.	
April 1st, 1884, afloat - -	148	—	790	—	—	155	486
Issued since - - -	102	—	619	—	1	94	314
	250	—	1,409	—	1	249	800
Returned since - -	111	—	641	—	—	105	347
April 1st, 1885, afloat - -	139	—	768	—	1	144	453

INSTRUMENTS at Stations, viz., Telegraph Offices, Observatories, Navigation Schools, &c.

April 1st, 1884, in use - -	111	4	251	62	59	35	41
Issued since - - -	9	—	20	10	5	4	—
	120	4	271	72	64	39	41
Returned since - -	7	—	10	8	3	3	—
April 1st, 1885, in use - -	113	4	261	64	61	36	41

DISPOSITION of Board of Trade Instruments on April 1st, 1885.

In merchant ships - -	139	—	768	—	1	144	453
In use at stations - -	113	4	261	64	61	36	41
In store at M.O. - -	30	1	111	6	46	43	97
At Liverpool Agency -	8	8	42	—	—	10	21
„ Aberdeen „ -	4	—	13	—	—	2	33
„ Glasgow „ -	4	—	28	—	—	4	17
„ Dundee „ -	6	—	17	—	—	7	19
„ Hull „ -	5	—	31	—	—	8	20
„ Southampton „ -	6	—	28	—	—	8	25
„ Cardiff „ -	1	—	14	—	—	6	10
Total, April 1st, 1885 -	316	13	1,313	70	108	268	736
Lost, &c. since April 1st, 1884	3	—	122	—	—	9	47

APPENDIX VI.

LIST of STATIONS reporting Meteorological Observations by Telegraph to the Office on 31st March 1885, with the Names of Observers.

*†Sumburgh Head	Rev. W. Brand	Minister of Dunrossness.
*†Stornoway	D. MacDonald	Late Officer S.S. "Great Eastern."
Wick	J. Sinclair	Watchmaker.
Nairn	W. D. Penny	Schoolmaster.
*†Aberdeen	J. McCormack	Telegraph Clerk.
Leith	W. Hay	Do.
*†Shields	J. W. Irvine	Do.
Spurn Head	J. B. Smith	Assistant Lightkeeper.
†York	H. M. Platnauer	Curator of Museum.
Loughboro'	W. Berridge, F.R.Met.Soc.	
†Ardrossan	J. W. Mayes	Telegraph Clerk.
Malin Head	P. O'D. Farren	Signalman, Lloyd's.
*†Mullaghmore	K. Kerr	Retired Coastguard Officer.
*†Belmullet	Miss M. J. Tolan	Telegraphist.
Donaghadee	T. MacGowan	Telegraph Clerk.
Parsonstown	B. Budds	Assistant Observer at Lord Rosse's Observatory.
Barrow-in-Furness	W. S. Whitworth	Engineer, Barrow-in-Furness Railway.
*†Holyhead	C. Durham	Keeper of Sailors' Home.
Liverpool	J. Hartnup, junr.	Bidston Observatory.
*†Valencia	J. E. Cullum	Superintendent of the Observatory.
Roche's Point	W. Kennedy	Telegraph Clerk.
Pembroke	Messrs. Blake and Baker	Lightkeepers.
*†Scilly	W. Thomas	Signalman.
Prawle Point	J. John	Coastguard Officer.
†Hurst Castle	G. G. Appleton	Lightkeeper.
†Jersey	J. Fisher	Signalman.
*†Dungeness	P. Curnow	Lightkeeper.
*†London	F. Gaster, F.R. Met. Soc.	Clerk, Meteorological Office.
Oxford	W. Wickham	Radcliffe Observatory.
Cambridge	H. Todd	Observatory.
*†Yarmouth	G. T. Watson	Secretary, Sailors' Home.
‡Hawes Junction	W. Foster	Station Master.

Note.—Those stations marked with an asterisk (*) report also at 2h. p.m.; and those with a dagger (†) at 6h. p.m. ‡ This station now reports by post only.

APPENDIX VII.

REPORTS ON THE INSPECTION OF THE STATIONS IN 1884.

A.—Report of Inspection of the Irish and Welsh Stations with Dungeness.

Telegraphic Reporting Stations.

I have the honour to report that on the 15th May I went to Dungeness, taking with me the instruments required for the establishment of the telegraphic reporting station at that point. I found the locality very well suited for the purpose, as the point is very low, and there is, for the distance of several miles, no hill which could affect the wind.

The principal lightkeeper, Mr. Lloyd, seems intelligent, and has already had considerable experience in weather reporting for the Trinity House.

The barometers are erected in his house, the thermometer screen in his garden, and the rain gauge at a little distance from the buildings.

The telegraphic wires have been carried to the signal station, situated in the Redoubt, distant more than a quarter of a mile from the lighthouse. It will be necessary to make some provision for a messenger to carry the reports to the telegraph office. As soon as the reports are quite satisfactory the station will be substituted for Dover.

St. Ann's Head (visited August 20th).—This station calls for no remark.

Parsonstown (visited August 27th).—This station continues very satisfactory, except in the arrangements for observing, the observers being two clerks in land agent's offices, one of whom takes the telegraphic and the other the second order (climatological) observations. It is very desirable that a better system should be introduced.

Belmullet (visited September 10th).—I found that it was necessary to change the observer appointed to this station, and I appointed Miss Mary Tolan, the telegraph clerk, as reporter. The exposure of the thermometers and rain gauge is not improved by the change, as they are now in a garden and not on the open hill side, but I think the arrangement I made is the only one possible. It appears to work well, and the observations have been published since October 1st.

Valencia (visited September 25th).—There is nothing to remark as to the telegraphic reports.

Roche's Point (visited September 26th).—The station was in good order.

Donaghadee (visited October 1st).—There is nothing further to report about this station, which continues quite satisfactory.

Mullaghmore (visited October 3rd).—This station is in good order. It is not yet certain whether Mr. Kerr can continue at Mullaghmore after the close of the current year.

Malin Head (visited October 8th and 9th).—This station is extremely well exposed. It is a signal tower situated on an isolated hill 200 feet high, close to the coast. The sea is visible except between east and south. There are no mountains near to divert the wind.

One barometer is placed in the tower, the other in the observer's bedroom at Slievebawn, distant two miles from the tower. The rain gauge and thermometer screen are placed on the hill top near the tower. The observer is Lloyd's signalman, P. Farren.

Holyhead (visited October 13th).—The reporter at this station (Caleb Durham) has only recently been appointed. He will, I think, make a good observer. The instruments are in good order.

STATIONS FOR THE WEEKLY WEATHER REPORT.

Llandovery (visited August 19th).—This is a new station. The observer is Mr. Jonah Watkins, bank manager. The site is not very good, as the only space available is that of a small garden. The instruments are not of high quality.

Waterford, Brook Lawn (visited August 22nd).—This is also a new station. The observer is Mr. C. P. Bolton, F.R.Met.Soc. The instruments are good and well exposed, and there is good hope of the station being a permanent one.

Kilkenny, The Castle (visited August 23rd).—This is also a new station, established by the Marquis of Ormonde, who is himself the observer when at home. The arrangements are all satisfactory. I have hopes that this station may become one of the second order.

Foynes, Mount Trenchard (visited September 23rd).—This station continues in the same condition. The observer cannot find a substitute when he is occasionally absent.

Killarney (visited September 26th).—This is a new station situated about a mile from the town. The observer is the Rev. G. Robert Wynne, F.R.Met.Soc. The instruments are of good quality, and the exposure good, except for wind, which is much affected by the proximity of mountains.

STATIONS OF THE SECOND ORDER.

St. David's (visited August 21st).—This station was, as usual, in very good order. The thermometers and rain gauge had at the date of my visit been temporarily placed in a garden, but were very shortly to be moved to a site in an open field.

Galway (visited August 29th).—This is a station which I hope may be made a climatological one. The observer is W. Ryan, assistant to Professor Larmour, Professor of Physics at the Queen's College. The observations are carefully taken, but the exposure of thermometers and rain gauge is not good, being in a garden with many fruit trees in it. The instruments are good.

Dublin, Fitzwilliam Square (visited September 27th).—This station continues as satisfactory as it is possible for a town station, with a limited garden exposure, to be.

Dublin, Glasnevin (visited September 30th).—The observations are very well taken, and the station in good order.

Dublin, Mountjoy Barracks (visited October 11th).—The new scaffolding for the anemometer and sunshine recorder has been erected. The station is in complete order.

Colebrooke (visited October 2nd).—This station is in good condition, but some doubt exists as to its height above sea level, which inquiry at the Ordnance Survey Office at Mountjoy Barracks failed to remove. It will be necessary to have the ground re-levelled for a distance of about two miles from the nearest Ordnance Bench Marks.

Markree (visited October 4th).—This station is in good order, Mr. Marth taking much interest in the work. He has, however, no assistant at present.

Londonderry (visited October 7th).—This station is in a fairly good condition. The observer, J. Conroy, was absent on the day of my visit, but his son was quite competent to act as his substitute.

OBSERVATORIES.

Valencia (visited September 25th).—The new anemometer has been put up, and works quite satisfactorily. The other instruments continue in good order.

I find that a new gate is required for the yard, and some other minor repairs were ordered to be taken in hand.

If the Council contemplate the erection of an electrical anemometer, it will be necessary to bear in mind that the Post Office telegraphic Linesman lives at Rossbeigh, at a distance of over 20 miles from the island.

Armagh (visited October 2nd).—The photographic self-recording apparatus at this station has been packed up by Mr. Whipple awaiting the decision of the Council as to its disposal. It will be necessary to supply some instruments to the observatory to enable Dr. Dreyer to carry on his observations.

THERMOMETERS.

The following table gives the results of comparisons made with Inspector's standard No. 3,349, and the thermometers at the different stations, the readings of the standard being corrected for instrumental errors, none of the Kew corrections for the station thermometers, however, being allowed for:—

STATIONS.	Dry Bulb.	Wet Bulb.	Max.	Min.	Spare Therm.	Notes.
	°	°	°	°	°	
Colbrooke	−0·3	+0·2	+0·1	+0·2	—	
Dublin (City)	−0·3	−0·3	−0·8	+0·2	—	
Dublin (Phœnix Park)	−0·8	−0·3	−0·3	0·0	−0·5	Grass min. −0°·1.
Glasnevin	+0·1	−0·2	−0·5	+0·7	—	Grass min. +1°·7.
Londonderry	−0·4	−0·6	−1·0	+0·2	−0·2	
Markree Castle	−0·1	−0·1	+0·1	+0·1	—	
Parsonstown	−0·6	−0·4	−0·2	+0·4	—	
St. Davids	−0·2	−0·3	+0·3	−0·2	—	Grass min. −0°·1.

——	Dry Bulb.	Wet Bulb.	Max.	Min.	Spare.	Remarks.
TELEGRAPHIC REPORTING STATIONS.						
	°	°	°	°	°	
Donaghadee	−·1	+·3	−·1	−·5	—	
Mullaghmore	−·3	−·2	+·1	−·2	−·1	
Parsonstown	+·6	+·4	−·1	−·3	—	
Valencia	+·4	+·4	+·9	−·2	+·8	
Roche's Point	+·3	+·3	+·9	−·8	—	
Holyhead	+·4	+·2	+·3	·0	+1·0	
Pembroke	+·6	+·5	−·3	+·1	+·5	
WEEKLY WEATHER REPORT STATIONS.						
Foynes	+·4	+·4	+·4	−·4	—	Wet bulb was too wet, glass too near bulb.
Galway	+·3	·0	−·2	−1·0	—	
Waterford	+·2	+·3	+1·2	−·3	—	Grass min. −0°·5.

(Signed) ROBERT H. SCOTT.

B.—REPORT of the INSPECTION of the ENGLISH STATIONS.

The state of my health precluding me from taking the whole work of inspection this year, Mr. D. Wilson Barker, F.R.Met.Soc., undertook a large portion of the task for me, and was, at my recommendation,

appointed deputy inspector of the stations in the north and east of England for this year.

His report is as follows :—

TELEGRAPHIC REPORTING STATIONS.

Brixton.—Everything in excellent condition, and observations taken regularly.

Loughborough.—All instruments in excellent order and carefully attended to. The position of the screen is not very good, being in a garden with wall round. No better place is available.

Liverpool.—I tested the observatory standard thermometer with which the other thermometers (used for reporting) are frequently tested, and they only differed 0°·1.

Barrow-in-Furness.—All instruments clean and in good order, and are well attended to. But the position of the screen is bad, partly surrounded by shrubs, and facing a wall.

N. Shields.—The screen has been shifted nearer edge of square since last inspection, but this will not affect the results much. The wind's direction has always been reported as magnetic, under the impression that it was true direction. Rain-gauge rim rather out of order. Other instruments clean.

York.—The position of the instruments here is fairly good, the screen being somewhat sheltered by large trees. Observations are taken by one of the gardeners employed in the grounds.

Spurn Point.—Since the last inspection the screen has been turned round, as directed by Mr. Ley, and now faces N.N.W. (true). Al instruments in good order, and observations carefully attended to.

Yarmouth.—All instruments clean and in good order. The screen is not well placed, having its back resting against a wall, but it faces N. ½ E. (true). The position cannot well be altered.

Cambridge.—Instruments clean and in good order. Screen somewhat sheltered by shrubs.

STATIONS of the SECOND ORDER.

Chatham.—The observers take a good deal of trouble over the observations, but owing to the school duties, they are liable to be interrupted, and the instruments, though in good positions, are scattered. The screen faces in a southerly direction. Wet bulb very foul.

Leicester.—Instruments clean and in good order. The vane used for reporting the direction of the wind points magnetic.

Sheffield, Weston Park.—This is a new and good station. The instruments have a good exposure, but the screen is painted green, the Museum Committee objecting to the white paint. The observer, living some distance from the museum, finds it difficult to attend to the evening observations. A wooden frame barometer is in use, but the Museum Committee might procure a proper instrument if the Council proposed it to them, as the observations would then be much more valuable. Suitable station for an anemometer.

Prestwich.—Instruments in good position, clean, and well attended to.

Isle of Man, Cronkbourne.—This is an excellent station. All instruments in good order and great care taken with the observations.

Peel.—Since the last inspection the instruments have been shifted, and are now in a yard at the back of the observer's house. The position is not very good. The observations are carefully taken. The

instruments all clean. If the screen could be moved on to a grass plot on one side of the house it would be better.

Newton Reigny.—A new and excellent station, in charge of a careful observer. Everything in perfect order.

Aysgarth.—Everything in excellent order.

Durham.—The rain gauge shaky. All other instruments clean and in good order.

Seaham.—Instruments in good order. Screen shaky, and sheltered a little by shrubs. The anemometer works very well.

Geldeston.—Solar radiation thermometer out of order. All other instruments in excellent order. Allowances are made for error in solar radiation thermometer. Observations very carefully taken.

Saffron Waldon.—Instruments clean and in good order. A new wet-bulb thermometer has been in use since last inspection. From the position of this station, on a gently sloping hill, the wind's direction will not show truly for the neighbourhood. The observer having no assistants, and his time much occupied, finds it impossible to get observations at times.

Oscott.—It being vacation time the observer was absent, and the gardener takes the thermometer readings. No one there could read the barometer correctly. Position of instruments good, and it is to be regretted that the observations cannot be kept up properly.

Stokesay.—The screen has been shifted since last inspection, as suggested by Mr. Ley, and now faces E.N.E. (true). The barometer is much out, reading ·054 higher than the standard instrument. The observations are well attended to.

Stations for the Weekly Weather Report.

Alnwick.—Observations taken regularly. The thermometers are of Six's pattern, fitted in a window about 21 feet from the ground. The anemometer gives some extraordinary results, giving great velocity for southerly and south-westerly wind, and registering small velocities for northerly winds of apparently the same force. It is situated at the east corner of one of the castle towers, and is no doubt affected by up-drafts. The cups are at far too great a distance from the registering drum to give good results.

Cirencester.—The thermometers used here are unverified and mounted on wood, stems not graduated, but only read 0°·1 different from the standard thermometer; tested in water. This station is in a good position, and would be very suitable for a Second Order Station, if arrangements could be made for the observations to be taken.

(Signed) D. W. Barker.

I have incorporated the instrumental comparisons made by Mr. Barker with those made by myself in the tables appended to this Report.

The following stations in the south and west of England were inspected by me this year:—

Telegraphic Reporting Stations.

Prawle Point (inspected September 17th).—The observer, Mr. J. John, and, in his occasional absence, the chief boatman, Mr. Kessell, continue to conduct the observations with great care. The instruments were all in excellent order. Gave instructions as to the temporary

shifting of the barometers, necessary on account of the re-painting of the room. They have been moved without injury.

Scilly (September 21st to 23rd).—The observer's health some time since broke down, but it has been again restored, and the observations are carefully conducted. Such steps as I was able to take to secure the services of a deputy have been explained in two letters to the Secretary. The thermometers and barometers were in good order. Portions of the anemometer were somewhat corroded, and the clock, which had stopped on the day of my arrival, much required cleaning. I therefore dismounted the instruments, and with the assistance of a watchmaker from Penzance, cleaned and repaired them, with the exception of the brush of the vane, which is totally worn away. Ordered the exterior of the anemometer case to be re-painted. The traces of the anemograph are still occasionally faint, owing to the salt and moisture. The rain gauge required some slight repairs.

Jersey (visited October 4th).—The observations are faultlessly conducted, and the instruments are in excellent order.

Hurst Point (visited October 17th).—The instruments were all in good order. Mr. Appleton continues to read the barometers correctly and the thermometers somewhat roughly. The rain gauge required rectifying. The tube and cap of the thermometer screen had gone to pieces, so that rain occasionally found access to the instruments. I had a new tube and cap made at Lymington.

STATIONS of the SECOND ORDER and for the WEEKLY WEATHER REPORT.

Arlington Court (inspected September 16th).—The instruments at this station appear to be very well attended to. The exposure of all of them is most admirable, and I am of opinion that the situation is most favourable for a Second Order Station, should Lady Chichester consent to its institution as such.

Totnes (September 18th).—At this station of the Second Order the observations are well conducted, and the records well filled. The position and condition of the instruments are unexceptionable.

Plymouth (inspected September 18th).—The observer, Mr. J. Merrifield, Ph.D., F.R.A.S., conducts the work at this Weekly Weather Reporting Station with much care, but the exposure of none of the instruments, excepting the sunshine recorder, is good, and it seems improbable that a better will be obtained.

Helston (September 25th).—The observer, Mr. Gill, who is a schoolmaster, is fairly accurate and painstaking. The observations were interrupted in January and February of this year owing to an outbreak of fever in the observer's house. The barometer, by Casella is in a brass frame, has not been verified at Kew, but has been compared for a long period with the observatory standard at Falmouth, and has a correction of $+0\cdot10$ uniform throughout the scale. The field in which the rain gauge has hitherto been placed, having been converted into arable land, the instrument has been shifted into the observer's kitchen garden. It is not here properly exposed, and I should recommend that it be fixed to the summit of a stone pillar at the end of the garden, for, although its rim would thus be more than 5 feet above the ground, the exposure would be a great deal more satisfactory.

St. Aubin's, Jersey (visited October 6th).—All the instruments at this station were found to be, as usual, in excellent order, and the records are very complete.

Southampton (October 16th).—The utmost care is taken in the observations made at this station, and I found the instruments to be all in the best condition.

St. Leonard's (October 20th).—The observations at this station are carefully taken, and the instruments are well attended to.

St. Edmund's College, Ware (October 20th).—This new station of the Second Order is situated on a hill, and has an excellent exposure. The observer is the Rev. B. Ward, who formerly assisted in taking the observations at Oscott. The barometer, which is in laboratory of the College, stood close to the fireplace and was too high above the floor to be read with ease. I requested that it should be removed to a more convenient position. The thermometer screen and rain gauge are near the middle of a large lawn on the west or front side of the College. I ordered that the screen should be turned round, so as to open to the north, instead of the south, as it did at the date of my visit.

Cooper's Hill (inspected October 21st).—The instruments of this Second Order Station are in excellent condition, but the evening observations are still taken at 3 p.m. instead of at 9 p.m. The barometer, which is a very good instrument, has been verified at Kew since my last inspection.

Harpenden (inspected October 23rd).—The mean temperature at this station, after allowance is made for altitude, appear about 1° too low. I am unable to say with precision to what cause this circumstance is due. It is conceivable that this may be partly due to the use of the screen "Stow's No. 2."

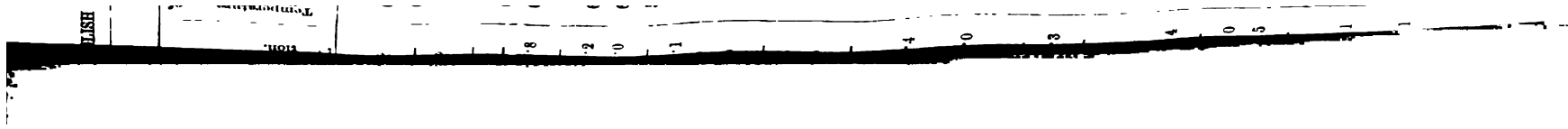
Rothamsted (October 23rd).—At this Weekly Weather Reporting Station the thermometers are those quoted for Harpenden. The rain gauges are in good order and the rainfall records well kept.

Table I. shows the results of the barometric comparisons made this year at the English stations. In Table II. the differences between the observer's and inspector's readings of the thermometers and also the differences between the readings of the thermometers in water and those of the inspector's standards are tabulated. Mr. Barker employed the instrument No. 3,348 as his standard; and I used two thermometers, B. T. 1,314 and Casella 30,523. There was occasionally a trivial difference between the readings of the two latter instruments, and in these instances the mean of the two (corrected) readings is given as that of the standard.

The readings of the inspector's standard barometer employed for the comparisons in Table I. are throughout corrected for index error, those of the reporting and spare barometers uncorrected.

TABLE I.—BAROMETERS at the ENGLISH STATIONS.

Station.	Reporting Barometer.			Check Barometer.	
	Height of Mercury.	Difference of Observer's from Inspector's Reading.	Error of Instrument as compared with Standard.	Height of Mercury.	Difference of Observer's from Inspector's Reading.
Aysgarth	29·513	+·003	+·012	—	—
Barrow-in-Furness	30·103	−·001	—	30·043	+·008
Brixton	30·127	−·002	—	—	—
Cambridge	30·152	−·004	—	—	—
Chatham	29·915	−·002	−·010	—	—
Cooper's Hill	30·058	−·001	—	—	—
Cronkbourne	30·151	−·001	—	—	—
Durham	29·759	+·001	−·004	—	—
Geldeston	30·187	+·002	—	—	—
Harpenden	29·590	−·010	—	—	—
Helston	30·068	+·001	—	—	—
Hurst Castle	30·456	·000	—	30·451	−·001
Jersey	30·368	·000	—	30·371	+·001
Leicester	30·029	−·019	+·030	—	—
Loughborough	30·076	−·002	—	—	—
Newton Reigny	29·571	+·003	−·010	—	—
Oscott	29·665	—	+·006	—	—
Peel	30·076	—	−·004	—	—
Prawle Point	30·037	−·001	—	30·039	−·003
Prestwich	29·749	−·005	−·001	—	—
Saffron Walden	30·023	+·001	—	—	—
St. Aubyn's	30·335	·000	—	—	—
St. Leonard's	30·325	+·001	—	—	—
Scilly	30·090	·000	—	30·091	+·001
Seaham	29·892	+·001	+·022	—	—
Sheffield	29·950	+·001	+·009	—	—
Do. Weston Park	29·780	—	−·004	—	—
Shields, N.	29·933	−·001	—	29·931	−·005
Southampton	30·375	·000	—	—	—
Spurn Head	29·981	+·001	—	29·980	+·001
Stokesay	29·984	+·011	+·061	—	—
Ware, St. Edmund's College.	30·022	−·002	—	—	—
Yarmouth	30·059	+·001	—	30·046	−·008?
York	29·943	+·003	−·001	—	—



tion.	Temperature of Water according to Reading of Thermometer. T.
	63·3
	65·8
	66·2
	62·8
	67·5
·8	63·8
	—
·2	60·9
·0	65·3
	59·7
·1	66·8
	52·9
	58
	56·0
	58·0
	59·2
	—
	63·8
·4	58·8
	60·3
0	59·6
	67·4
	63·8
3	81·3
	52·6
	61·0
	59·6
·4	56·0
	61·0
0	63·4
5	—
	65·4
	65·0
1	52·9
	69·4
1	54·3
	67·9
	54·8
	67·8
	70·0
	70·0

C.—Report of Inspection of the Scottish Stations.

Barometers.

The barometers at the various stations were compared with inspector's mercurial standard barometer No. 588, and I have again the satisfaction to report that this standard barometer has not yet once been detected to be out of order. On all tours of inspection it was compared some days before leaving, and some days after returning to, Edinburgh, with Board of Trade Standard No. 958, which remains constantly in my house. The small aneroid No. 11 was also read at each inspection, since such readings, which are quite unsuitable for trustworthy comparison, might possibly be of use in case of an accident occurring to any of the barometers.

The following table gives the corrected readings of standard No. 588, and the uncorrected readings of the reporting and check barometers at each of the stations, and it will be seen that all the instruments continue to be in excellent order:—

Stations.	Inspector's Standard No. 588, Corrected.	Reporting Barometer. Uncorrected.	Check Barometer. Uncorrected.	Remarks.
Laudale - -	29·825	29·828	—	House under repair. Check barometer dismounted.
Stornoway - -	30·030	30·028	30·029	
Sandwick - -	29·767	29·780	—	
Dunrossness -	29·463	29·462	29·465	
Wick - -	29·558	29·558	—	In shop.
Do. - -	29·488	—	29·490	In house.
Dunrobin - -	29·698	29·797	—	
Inverness - -	29·556	29·556	—	
Nairn - -	29·445	29·444	29·443	
Aberdeen - -	30·164	30·166	—	In post office.
Do. - -	30·117	—	30·118	In house.
Braemar - -	29·250	29·260	—	
Dundee - -	30·072	30·070	—	
Glenalmond -	29·455	29·454	—	
Leith - -	29·774	29·765	—	In post office.
Do. - -	29·753	—	29·746	In house.
Pinmore - -	29·383	29·384	—	
Rothesay - -	29·765	29·766	—	
Ardrossan - -	30·094	30·092	—	In post office.
Do. - -	30·062	—	30·061	In house at Saltcoats.
Observatory, King's College, Aberdeen	30·229	30·230	—	

The results of comparisons made with inspector's standard thermometer No. 2,522, and the thermometers at the different stations,

and at Aberdeen Observatory, are given in the following table. The readings of the standard have been corrected for instrumental errors, but none of the Kew corrections for the station thermometers, however, have been allowed for :—

STATIONS.	Standard No. 2,522, Corrected.	Dry Bulb.	Wet Bulb.	Spare Thermometer.	Maximum Thermometer.	Minimum Thermometer.	Time in Water in Minutes.	Change of Temperature of Water.	Notes.
	°	°	°	°	°	°		°	
Laudale -	60·7	+0·2	+0·1	—	+0·2	+0·2	110	+0·4	
Stornoway -	54·8	+0·6	+0·5	+0·4	−0·3	−0·5	90	Uniform	
Sandwick -	56·0	+0·2	−0·1	—	+0·5	−0·5	120	+0·5	
Dunrossness	57·7	+0·3	+0·4	+0·2	+0·3	−0·7	165	+0·3	
Wick - -	62·8	+0·3	+0·4	—	−0·1	+0·1	90	−0·2	
Dunrobin -	61·3	−0·4	−0·5	—	+0·6	−0·6	100	Uniform	
Inverness -	54·6	—	—	—	0·0	+0·1	100	Do.	Hygrometer broken. New one ordered.
Nairn -	55·2	+0·2	+0·7	+0·7	−0·1	+1·0	135	+0·2	
Aberdeen -	63·5	+0·4	+0·5	+0·4	+0·6	+0·1	130	Uniform	
Braemar -	62·6	+0·5	+0·5	—	+0·5	−0·1	150	Do.	
Dundee -	57·0	+0·5	+0·5	—	+1·4	−0·4	80	Do.	
Glenalmond	55·1	+0·1	+0·1	—	+0·1	−0·3	60	Do.	
Leith - -	56·2	+0·2	+0·5	—	0·0	−0·2	50	Do.	
Pinmore -	48·8	+0·2	+0·3	—	−0·3	−0·1	80	−0·2	
Rothesay -	47·1	−0·1	0·0	—	0·0	−0·3	180	Uniform	
Ardrossan -	49·7	+0·3	+0·4	+0·1	0·0	−0·3	70	Do.	
Observatory, King's College - -	59·8	−0·2	+0·3	—	+0·2	−0·4	180	Do.	Observatory.
Do. -	59·8	+0·2	+0·1	—	+0·2	+0·2	180	Do.	In Stevenson's screen.

Laudale (inspected August 19th).—The instruments were all in good order, and the observations appear to be carefully made. At the time of inspection the house was undergoing extensive repairs, the whole of the interior being nearly gutted. The check barometer was packed away in its box. The reporting barometer was not then removed, but in a few days it was to be taken from its place for a short time. As Mr. Fletcher quite understands the handling of his barometer, it is not supposed that any injury will happen to the instruments during the changes.

As requested, I examined the observation book for 1880, which is one that was supplied by Mr. Newton and has no columns for clouds. In July of that year Mr. Fletcher was from home nearly the whole month, when the observations were made by his brother. These observations Mr. Fletcher seems to have understood at the time, but evidently he cannot now interpret them so as to give the details of cloud correctly, as desired by the Office.

Stornoway (inspected August 25th).—The thermometer screen and rain gauge were removed October 11th, 1883, to the positions indicated in last year's report. These positions are good, and all the instruments were in good order.

Sandwick (inspected August 27th).—The instruments were in excellent order, and to meet contingencies, another of Dr. Clouston's servants, Ann Souter, had been taught to observe, which she does quite correctly.

The orientation of the anemograph was examined. The cardinal points on the horizon were determined by magnetic compass, a variation of about 23° being allowed for. These points agreed with the points determined by Mr. Scott some years ago. Referring the indication of

the anemograph to these points, the orientation of the instrument was found to be correct.

The spiral thread of the direction pencil was next compared with reference to the sheet on the cylinder which was seen to be correctly placed, the pencil projecting just as far beyond the N. line at the foot as it did beyond the N. line at the top of the sheet. A careful examination, however, showed that from a point about mid-way between N.E. and N. the spiral thread of the pencil had received a twist, so that this portion will cease to mark till the rest of the pencil be worn down some little way. Fortunately, however, the pencil has been so long in use that the indications which fail at the foot of the sheet are supplied by indications at the top, and this is done so completely that no hiatus is left. Instructions were accordingly given to fix the sheet on the cylinder as before.

A reference to the curves in the Meteorological Office will show when the anemograph ceased to record this part of the curve, whether, for instance, it was at the time when the instrument was last repaired by a local workman.

At the time of inspection the wind suddenly changed from about E. to S.S.E., blowing, roughly speaking, from six to eight miles an hour, and dying away to a calm in a space of time less than 10 minutes. The anemograph seemed much too sluggish in indicating this change of direction.

While afterwards inspecting the observatory at King's College, Aberdeen, I made inquiry regarding the working of the anemograph there, and Mr. Boswell kindly showed me changes in the wind's direction, with small velocities, on the sheets of August 31st, and September 1st and 3rd. On the first of these dates at 10 p.m., with a velocity at the rate of four miles an hour, the anemograph recorded a change from S.W. to W. almost instantaneously.

It may be a matter for consideration by the Meteorological Council whether during next year's inspection Mr. Whipple should not go to Sandwick, and put this anemograph into a thorough state of repair.

Dunrossness (inspected August 30th).—The instruments were in good order, and were correctly observed. The maximum and minimum thermometers are neither of them engraved on the stem, and as the error of the latter is large,— 0°·7, it might be considered whether a new set of these thermometers might be supplied to this station.

The delay in the receipt of the telegrams from Dunrossness has not been occasioned by any remissness on the part of the observer or of the telegraph clerk at Boddam, but has arisen entirely at Lerwick. The postmaster at Lerwick informed me that scarcely, if ever, are the weather telegrams so late as 8.30 a.m., 2.30 or 6.30 p.m. The telegrams on reaching Lerwick must wait their turn to be transmitted, which, during the herring season, for example, means sometimes a delay of three or four hours. Another cable is to be laid in April next, when these delays, I was informed, will cease.

The observations of the previous eight months were examined as to the entries of extreme wind force. So far as Mr. Brand could recollect, every case equalling 8 or upwards was reported at the time. The number of cases was smaller than I should have anticipated, though Mr. Brand's estimate of force agrees closely with that of the observers at the other stations.

Wick (inspected September 2nd).—The observations here are made with much intelligence, and the instruments were in very good order

Orders were given to execute some necessary repairs on the thermometer screen and repaint it.

Dunrobin (inspected September 4th).—The instruments remained as at the time of last year's inspection, the Stevenson's screen not having been added owing to a difficulty the joiner had in understanding the sketch-plan sent. This was explained, and the screen would be ready in a few days after inspection.

The amount of cloud is to be added to the observations. An attempt will also be made to observe the force of the wind, but it must be added that the hills to the westward and the woods in the immediate neighbourhood render it difficult to make quite satisfactory observations of the force of the wind.

Inverness (inspected September 5th).—The observations at this station have, for various causes, been for some time interrupted. Mr. Fraser removed to his present house, of which he has taken a lease for some years, in May last, but delayed resuming the observations till after inspection, when he could have advice regarding the positions of the instruments.

A new hygrometer had been ordered and was being compared at Kew, and it was fully expected that the observations would be resumed on October 1st.

Nairn (inspected September 6th).—The Stevenson screen was ordered to be repaired and repainted, and the rain gauge to be removed to a place 24 feet S.S.E. of its present position, the change being necessary owing to the growth of a young apple tree. At last the trees in the adjoining plantations have been cut down for a distance of from 50 to 80 yards from the boundary wall of the school grounds, thus greatly improving the station in many respects. Much attention is given by Mr. Penny to the instruments, and to the systematic training of his assistant.

Aberdeen (inspected September 9th).—The Stevenson screen was painted immediately after last inspection, and everything was in excellent order. Both assistants made the observations and reduced them with correctness and despatch. Other two of the clerks were under training as assistants, should their services be at any time required.

Aberdeen, King's College Observatory (inspected September 10th).—The instruments were all in excellent order. The anemometer and its registrations were examined with some care, and the results showed it to be in remarkably good working order. A Stevenson screen has recently been added to the observatory, and has been placed in the best situation afforded by the University grounds. The ground for some distance round the screen is to be turfed, and the thermometers have been hung in positions and at heights comparable with those at the ordinary stations of the Office. As the results of the comparison of the thermometer did not quite agree with last year's comparison, I remained an hour longer, and thereafter Mr. Boswell and I made another independent reading of all the thermometers which agreed with two previously made readings. Hence the thermometer's errors given in the table are the comparisons by two observers of the thermometers with No. 2522 (corrected), all the thermometers having been in water together for three hours, during which its temperature did not change so much as the tenth of a degree.

Braemar (inspected September 11th).—The instruments were in good order. A Stevenson screen was just added with maximum and minimum thermometers and a hygrometer, with which observations

have been made since October 1st for comparison with those made in the screen used at the station since 1855. The force of the wind is observed both by estimation and by a Robinson's Anemometer, which is on a stout post with ladder 18 feet high.

Dundee (inspected September 16th).—The instruments were all in good order, and they are observed with care. In August a new 5-inch rain gauge had been added to the station for comparison with the Fleming's gauge hitherto in use, both being placed in an open situation near each other in the grounds of the cemetery, about a furlong from the thermometers.

Glenalmond (inspected September 29th).—The instruments are all in the positions in which they were when the late Dr. Percy Robinson was observer, and they are in exellent condition. The observations are made with much care by the Rev. A. H. S. Pattrick, M.A., music-master, who, if his duties in the College will admit of it, will add the 9 p.m. observations to those now made.

Leith (inspected September 26th).—Except a slight discolouration in the muslin of the wet bulb, the instruments were in good order, and much interest is manifested by Mr. Hay in the observations and work of the assistants. The gate of the small railed-in enclosure, where the rain gauge and screen are placed, was ordered to be repaired.

Pinmore (inspected October 9th).—The instruments were in good order. The ground for some distance round the thermometer screen has been turfed since last inspection, and the minimum thermometer lowered to 4 feet. The observations are intelligently made, and the observer is desirous of making the schedule as full as may be in his power. Owing to the position of Pinmore, the winds are not unfrequently very light, and they can indicate only in a rough manner the general direction of the wind in that part of Scotland. No little trouble is taken by Mr. Donald, by climbing to the top of a knoll and otherwise, to secure correct observations of the wind. Fuller notes of weather and cloud are gradually to be added.

Rothesay (inspected October 11th).—The instruments were in good order and the observations very intelligently made. Since last inspection several low-growing shrubs have been removed from near the thermometer screen, and a plot has been turfed round the rain gauge. The direction of the wind is taken from a vane which works well on a pole 36 feet high. The amount of cloud is to be added to the schedule.

Ardrossan (inspected October 13th).—The instruments at this station were in good order, and both Mr. Mayes and the assistant made and reduced the observations correctly. The observation book was examined from January 1st downwards, and as regards the wind, an improvement commenced in the last week of January. The estimates of wind force were examined in detail, and these agreed on the whole very well with the estimates made at the other stations, with perhaps a tendency to rate the force one grade of Beaufort scale higher than the others. The faulty observations of the barometer pointed out by the Office were compared with those at the same dates made in Edinburgh, and, except in one doubtful case, the errors suspected by the Office were corroborated. The errors were not generally 0·050 inch, but mostly errors of 0·030 inch, some of them, perhaps made by the assistant, who at the time was new to the work, setting the vernier about 0·30 inch too low, but mostly by a 6 being put down for a 9, or 3 for an 8, and *vice versâ*. The readings of June 1st, made by the assistant, were altogether wrong. An improvement began in June, since which time I did not detect any faulty observations. The rain gauge on July 5th and 10th had been

tampered with, and Mr. Mayes much regretted that he failed to report the fact to the Office when he became aware of it. The more important sections of the recent issue of "*Instructions on Meteorological Telegraphy*" were gone over in detail with the two observers, and as both seemed thoroughly alive as to the requirements of the future, I have considerable confidence that their work will now prove satisfactory.

(Signed) ALEXANDER BUCHAN.

D.—REPORT on the INSTRUMENTS at the OBSERVATORIES.

Falmouth.—On August 2nd I visited the plot of ground designed for the site of the new observatory, and met several members of the Committee of the Polytechnic Society there.

By request, I checked, by means of my azimuth compass, the bearings of the lines laid down for the building preliminary to the excavation of the trenches for the foundations.

I dismounted, cleaned, and examined the anemograph, fitted new pricker, and tightened up a loose fan, oriented it by compass and by mark. I dismounted, cleaned, and examined barograph and thermograph, and improved the focus of the wet bulb, and compared the thermometers with the standard.

I found the Beckley rain gauge in good order, the shake in the trace being due to a defective fitting of the pencil, the holder being too small to hold a pencil unless it is carefully trimmed to shape. It has not been found practicable to adopt the suggestion I made on my last inspection as to the removal of the spare gauge. It would be very desirable to supply a second gauge to run at the new observatory some time before the present one is dismounted.

Valencia.—Immediately on my arrival, August 14th, I had the new anemograph unpacked and made arrangements for erecting it. The weather being uncertain at this station, I proceeded at once to dismount the old instrument. This being done, it became stormy, and we were unable to put the other up for several days. On August 20th it was completed, and having been oriented carefully by a solar observation, was set to work. The barograph and thermograph were examined and cleaned, being in good order, and the thermometers were compared with the standard. The Beckley rain gauge was also found to be in good condition.

A box chronometer formerly in use at the Armagh Observatory was conveyed by me to this observatory and deposited with Mr. Cullum for use as a standard timekeeper, the observations hitherto being controlled by means of an ordinary watch set from time to time by means of the clock at the Anglo-American Telegraphic Station-house.

Armagh.—This observatory no longer being one of the self-recording observatories of the Meteorological Council, Dr. Dreyer, the director, was desirous of having the instruments dismounted and packed away in order to avoid incurring the risk of their accidental injury or destruction. I accordingly dismounted the barograph and thermograph, carefully packing and securing the various pieces of apparatus in order that they might be stored away or forwarded to any place where the Council might decide upon their being deposited either for storage or further use.

The anemograph and Beckley rain gauge, being retained in operation, were examined and found to be in good order.

Holyhead.—Both the bridled and Beckley anemographs were examined. The former instrument was undergoing slight repair at the time of my visit, the top plate of the instrument being re-adjusted on the roof of the hut which protects it, on account of its position having become a little shifted by warping of the roof.

The Beckley anemograph was in good order, with the exception of the velocity pencil, which being indented in one place, caused an irregularity to appear in the trace whenever the defective portion came into contact with the recording cylinder. This I, in a great measure, rectified, by bending the pencil spiral and grinding the indented portion down. In fitting the instrument together, I inadvertently exchanged the cross clutches of the two recording pencils. Some days after my inspection this caused the instrument to fail during a brisk wind, but Mr. Williams, C.E., who has charge of both anemographs, detected the source of failure and replaced the clutches in their proper fittings. Since then the instrument has worked correctly. I examined the orientation and found it was properly performed by the man in charge.

Oxford.—The Radcliffe Observatory was visited on September 3rd. All the instruments were examined and found to be in excellent order. The thermometers were compared and found to require the following corrections :—

Dry bulb standard	$-0^{\circ}\cdot5$ Max.	$+0^{\circ}\cdot2$
Wet „	$-0\cdot4$ Min.	$+0\cdot1$

(Signed) G. M. WHIPPLE.

October 1884.

Aberdeen (visited by Mr. Baker on September 17, 18, 19).—All the instruments at this observatory were found in capital working order and the photography was good.

I thought it advisable, however, to entirely dismount the thermograph clock, as the oil had become somewhat thick, but as regards the barograph clock, only parts required cleaning, besides a general oiling.

The lenses and conductors of both instruments were carefully wiped.

The exposed parts of the anemograph were dismounted and thoroughly examined and oiled, but the clock did not require cleaning, having recently been taken down for the purpose of attaching a new clock line, when it was thoroughly cleaned.

Afterwards the orientation was examined, and the result is appended to this report.

The rain gauge was generally cleaned.

The standard dry and wet bulb thermometers were compared with a Kew standard thermometer in water at a temperature of 60 degrees, and the following corrections were derived from a mean of four readings :—

Dry, No. 458.	Wet Bulb, 395.
$-0^{\circ}\cdot05$	$0^{\circ}\cdot6$

Mr. Boswell having called my attention to the fact that there was a difference of some two or three tenths of a degree between the above corrections and those determined by Mr. Buchan during the week preceding my visit, we thought it well to compare the maximum and minimum in use in the thermograph screen as well as all the thermometers mounted in the Stevenson screen. These were all tested in water with the following results :—

MAXIMUM and MINIMUM used in THERMOGRAPH SCREEN.

Kew Standard, No. 571. Mean of 4 readings.	Maximum M.O. 48.		Minimum M.O. 89.	
	Mean of 4 readings.	Correction.	Mean of 4 readings.	Correction.
59°2	59°8	−0°6	—	—
59·2	- - -	- - -	59·0	+0·2*

Tested September 19.

THERMOMETERS employed in the STEVENSON SCREEN, situated in the Garden.

Kew Standard, No. 571. Mean of 4 readings.	B.T. 1755.		B.T. 1756.		Maximum 257.		Minimum M.O. 766.	
	Mean of 4 readings.	Correction.	Mean of 4 readings.	Correction.	Mean of 4 readings.	Correction.	Mean of 4 readings.	Correction.
59°25	59°55	−0°03	—	—	—	—	—	—
59·30	- -	- -	59·6	−0·3	—	—	—	—
59·30	- -	- -	- -	- -	59·7	−0·4	—	—
59·30	- -	- -	- -	- -	- -	- -	59·6	−0·3

The above comparisons indicate a constant difference of 0·2 higher than those of Mr. Buchan, which is most probably due to a difference between the two standard thermometers employed in the examination.

The Kew standard of reference was again compared with the observatory standard on my return to Kew, and found to be unchanged.

(Signed) T. W. BAKER.

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* This correction is some three tenths less than the one used by Mr. Boswell, but I carefully examined the chamber, and could not detect any spirit detached from the main column. To make certain, however, the chamber was warmed over a gas burner and afterwards the thermometer placed in a vertical position for about an hour, when it was recompared, but the above correction had not changed.

APPENDIX VIII.

METHOD of DEALING with TELEGRAPHIC WEATHER INTELLIGENCE.

The operations connected with the preparation and issue of the Forecasts and Storm Warnings have not undergone any great change so far as our own coasts are concerned, but Malin Head has been started as a Telegraphic Reporting Station.

Arrangements have been made by which information of storms met with to the westward of Long. 45° West by the large Atlantic steamers in their passage from England to the United States is forwarded telegraphically to the Meteorological Office by the Chief Signal Officer of the United States. These arrangements are referred to more fully further on. The Daily Weather Report also has been improved by the addition, in the margin, of means for each month of the daily maximum and minimum temperatures, in addition to the mean values previously published.

The Office now receives, when the telegraphic communications are perfect, fifty-four reports every morning, fourteen every afternoon (except on Sundays), and twenty each evening. The interruptions which have occurred at times in the communication with Sumburgh Head and Stornoway have not been serious, owing to the moderate force of the gales which occurred during the winter. The suspension of the afternoon reports on Sundays is due to the fact that almost all the telegraphic circuits are closed at the hours at which the messages would be transmitted. The instructions to the observers have not been altered during the year, and the system of observing cirrus cloud has not been materially extended.

The foreign reporting stations, 23 in number, extend along the entire western coast of the Continent, from Bodö in Lat. 67° N. to Corunna in Lat. 43° N., and include four stations on the coast of the Baltic, and one in the Mediterranean. The information is received in accordance with arrangements made with the various Meteorological organisations in France, Holland, Germany, Denmark, Norway, and Sweden.

At the British and Irish stations the morning observations are taken at 8 a.m. Greenwich time, and most of the telegrams arrive in London at about 9 o'clock, when the Intelligence Department of the Post Office extracts from them the portions required for its wind and weather reports. They are then transmitted to the Meteorological Office by its private wire, where the majority of them usually arrive between 9 a.m. and 10 a.m.

As fast as the reports come in, the information is entered on a chart, which shows for each station at 8 a.m. the barometrical and thermometrical readings, with their respective alterations during the preceding 24 hours, the direction and force of the wind, and the state of the weather, together with any changes of importance which may have been noticed in the course of the preceding day. From this chart,

which is preserved in the Office, other charts are drawn for publication in the newspapers, as described further on.

If necessary, telegraphic warnings of storms or of atmospherical disturbance is immediately sent to our own coasts and to foreign countries. A brief telegraphic resumé of the weather is despatched shortly after 11 a.m. to the Harbour Authorities in Jersey. Another telegraphic message, of about 75 words, is sent to the Underwriters' Association, Liverpool, containing reports of the pressure, wind and weather at 14 stations on the coasts of the British Islands; and a third message of about the same length is forwarded to the Central News and to the Exchange Telegraph Company for despatch to the provinces. The last of these messages consists of a brief statement of the general condition of the weather in Western Europe, as shown by the reports for the morning. It is, however, not in the morning only that storm warnings are issued to the coasts, for a constant watch is kept during the day, and whenever on the receipt of the regular or of special telegrams the condition of the weather appears to be threatening, cautionary messages are at once issued to such parts of the coast as are thought to be menaced by a gale.

During the year 1884, there were prepared each morning, afternoon, and evening, Forecasts of the weather, for one day in advance; these were drawn up for eleven districts in the British Islands, and issued to subscribers, to certain Clubs, and to many of the London and Provincial newspapers in accordance with the arrangements referred to on p. 11. The districts for which the Forecasts were prepared were those into which the returns for the Weekly Weather Report are divided, viz. :—

0. Scotland, N.
1. „ E.
2. England, N.E.
3. „ E.
4. Midland Counties.
5. England, S.
6. Scotland, W.
7. England, N.W. (with N. Wales).
8. England, S.W. (with S. Wales).
9. Ireland, N.
10. „ S.

About an hour and a quarter is occupied in the preparation and transmission of the provincial and foreign telegrams, and in the drawing up of the "Remarks" and 11 a.m. Forecasts for the London newspapers, so that the MS. copies for the "Times" and other papers are ready for issue soon after 11 a.m.

The Charts prepared daily for newspaper publication are as follows :—

For the "Times," - -	two daily, viz. :	for 8 a.m. and 6 p.m.
For the Patent Type-founding Company, on behalf of the "Shipping Gazette," and for distribution to the provincial press -	one „ .	for 8 a.m.

The 8 a.m. charts are sent out at about 10.15 a.m. and the 6 p.m. chart at about 8.30 p.m.

The draft of the Daily Weather Report, with two charts attached, is drawn on transfer paper, and is ready by noon, when it is at once sent to the lithographer to be printed. The copies for delivery by hand in London are issued at about 1.30 p.m., while the remainder are received at the Meteorological Office at about 3.30 p.m., whence they are transmitted by post to the subscribers and others.

In addition to the charts referred to above, the Patent Type-founding Company are supplied with various diagrams showing the changes in pressure, temperature, rainfall, wind, and weather for the London district. These are engraved *daily* for the "Daily Chronicle," *weekly* for the "Observer" and "Graphic," and *monthly* for the "Miller." They are all accompanied by remarks on the phenomena exhibited.

At about 3 p.m. the observations taken at twelve home stations at 2 p.m. are received, and those for two foreign stations (Skudesnaes and Rochefort) come in afterwards. Copies of these reports are issued, together with the 8 a.m. report, to certain newspapers and subscribers. Two copies of the "Remarks" (8 a.m. and 2 p.m.) are sent to the Type-founding Company for issue to provincial newspapers for publication, in order to explain the 8 a.m. charts.

From 7 to 7.30 p.m. the twenty evening (6 p.m.) reports arrive and are charted and discussed for the morning daily papers in accordance with the arrangement referred to on p. 11. The forecasts and remarks are usually ready by 8.30 p.m., but in bad weather, owing to the delay of the reports and the additional care which is necessary in dealing with them, it is frequently 9 p.m. before they are issued. The "Times" publishes in its first edition the daily map showing the distribution of pressure, the winds, temperature, and weather at 6 p.m., and in its second edition a similar map for 8 a.m. on the day of issue.

The official charts for 2 p.m. and for 6 p.m. are still much less complete than that for 8 a.m. That for 2 p.m. is drawn on the information received from twelve home stations, supplemented by two foreign ones, whenever the latter arrive in time to be used. The material for the 6 p.m. charts is now supplied by reports from sixteen stations in the United Kingdom, supplemented by four from continental stations, but the latter frequently arrive late at the very time when they are most wanted, *i.e.*, during bad weather.

The Sunday duty is still conducted as follows:—Two of the clerks attend on Sunday mornings at the Central Telegraph Station from 8.30 a.m. to about 10.15 a.m. By an arrangement with the Post Office these clerks are supplied with the telegrams immediately they arrive in London. These are examined and charted, with the view of issuing, when necessary, warnings of coming storms, to our own and neighbouring coasts. It is necessary that promptitude should be observed in this service, as the observations must be dealt with and the warnings issued so that the latter may reach the coast before the telegraph offices close for the day, which is usually at about 10 a.m. No work of any kind is transacted for the newspapers on Sunday mornings, the main object of the service being to give prompt information of storms to our coasts; but a telegram is sent to Jersey in the same way as on week days, and there is the ordinary interchange of messages with foreign countries. At 6 p.m. the same clerks attend at the Meteorological Office to receive the evening reports and to prepare the 8.30 p.m. Forecasts,

and another opportunity is thus offered for the correction or extension of any warnings which may have been issued in the morning.

Daily Weather Report.

Very little change has been made in the form of the Daily Weather Report since 1st January 1884. The information now fills four large quarto pages, and is arranged as follows:—

Page 1 contains the whole of the reports from which the maps for the day (given on page 2) are prepared; and also the 6 p.m. reports of the previous day; page 2 contains (1) a map of North-western Europe showing for 8 a.m. on the date of publication the distribution of pressure, the prevalent winds, and the sea disturbance, with necessary explanations; together with a table showing the mean pressure of the atmosphere for the month at 22 stations; (2) a similar map showing the distribution of temperature, the weather at each station, and the distribution of rainfall during the past 24 hours; together with tables of mean temperature of the air and of evaporation at 8 a.m. and of the daily maximum and minimum temperatures and the mean rainfall for the month at a large number of stations over the United Kingdom.

Page 3 contains (1) remarks on the principal features exhibited by the reports for the day; and (2) the forecasts drawn up for each district at 11 a.m. relating to the weather likely to be experienced during the 24 hours ending at noon on the day after that of publication.

Page 4 contains the reports and remarks for 2 p.m. on the previous day, and there is space for the insertion of a Weekly Summary on Mondays, and any other brief information which it is deemed necessary to print at once.

The standing portion of the report (the maps, &c.) is printed in blue, while the information for each day is in black.

Atlantic Telegrams.

In the course of the year arrangements have been made for forwarding from the United States occasional reports of gales, icebergs, and direlict ships, which have been met with by passenger steamers of the principal lines running from various European ports to New York or Boston. The vessels referred to are supplied with forms on which to enter the information necessary (see Appendix XIII., p. 88), and these are received by officers of the Chief Signal Office at the ports named. The facts are then sent by cable to the Meteorological Office in an abbreviated form, as follows:—

REPORT of a STORM, and EXPLANATION.

(Say, From New York) to Met. London.

"Scotia."	19.	Fifteen.	64.	South-west North-west.	293.	Nine.
Name of steamer supplying the information.	Date of lowest barometer.	Hour of lowest barometer. (=3 p.m.)	Longitude in which the lowest barometer was observed.	Direction of change of wind, about time of lowest barometer. (=S.W. to N.W.)	Lowest barometer observed. (=29·3 inches.)	Extreme force of wind during the storm. (=9, Beaufort's scale.)

Reports of ice and derelict ships relate to ice or derelicts seen on any part of the passage, and are worded thus:—

"Scotia."	Icebergs.*	Thirteen.	Fifty-four.
Name of steamer supplying the information.	Nature of ice observed.	Day of month when observed.	Longitude in which the ice was observed.

When a report of ice or of derelict ships is appended to one of a storm, the ship's name is not inserted unless the report of the storm and that of the derelict (or ice) be from different ships.

This information is published in the Daily Weather Report, and is also transmitted to the Meteorological Institutes of France and the Netherlands. A copy is sent regularly to Lloyd's.

Weekly Summary.

On Monday in each week a brief Summary of the Weather which has been experienced over our Islands during the preceding week is given on p. 4 of the Daily Weather Report. It refers only to the principal changes which have occurred, and is intended to serve as an aid to the study of the Daily Reports.

In this manner the main meteorological features of the week are presented as a connected story, and additional facility is afforded for future reference.

Correction and Addition List.

Additional steps are taken to insure accuracy in the Daily Weather Report. At the close of each month a return is received from nearly all of the telegraphic reporting stations, containing a copy of all the observations which have been transmitted to London by wire during the month. These schedules are used for checking the daily telegrams, for the preparation of the average and other values of the different elements, and also as evidence in the case of legal proceedings; and about the middle of every month a lithographic sheet has for many years past been issued with the Daily Weather Report, containing corrections for all discrepancies which have been discovered, and supplying any observations which have been omitted in the published reports. This monthly sheet also contains tables showing the mean values for pressure, temperature, and humidity, together with the total rainfall, and the prevalence of various kinds of weather and of winds from each of the eight principal points during the month, for each telegraphic reporting station within our Islands.

Weekly Weather Report.

The Weekly Weather Report has appeared since the beginning of February 1878. It consisted originally of four pages octavo, but has now been enlarged to four pages quarto, and has been further improved by the insertion on the last page of the number of day-degrees of

* "Derelict" is substituted for icebergs when necessary.

accumulated heat above and below 42° F. for each station from which observations are received. The Report thus contains the average and extreme temperatures and the rainfall values and the total amount of bright sunshine in each week, for seventy stations grouped into eleven districts in Great Britain and Ireland, together with the difference between them and their respective mean values for the corresponding weeks in previous years. In addition to this, the district values for Accumulated Temperature, Rainfall, and Bright Sunshine are given, both for the week and for the whole period since the beginning of the year.

The tables of Accumulated Temperature are designed to give persons engaged in agriculture better means of estimating the manner in which vegetation is affected by temperature than that afforded by the more usual methods of treating the readings of the thermometer. They show for each week, and for the whole period from the beginning of the year, the weekly and progressive values respectively, of the combined amount and duration of the excess or defect of the air temperature, above or below a suitably fixed standard or *base temperature*. The base adopted is 42° F., as being nearly equivalent to 6° Cent., which has been considered by Continental writers on these subjects to be the critical value, the temperature above which is mainly effectual in starting and maintaining the growth, and in completing the ripening, of agricultural crops in a European climate. This base is also convenient as being 10° F. above the Freezing Point.

The accumulated Temperature is expressed in Day-degrees; a Day-degree signifying 1° F. of excess or defect of temperature above or below 42° F. continued for 24 hours, or any other number of degrees for an inversely proportional number of hours.

It has been ascertained by calculation from a considerable series of hourly observations at various places, that the accumulated temperature may be computed, with a very tolerable approximation to the truth, from the observed daily maximum and minimum temperatures alone.

When the temperature during any period remains either wholly above or below the base temperature, the difference between the base and the mean temperature gives the correct accumulated temperature. In other cases this difference gives an approximate value of the accumulated temperature which does not depart greatly from the truth, the deviation depending on the greater or less extent of the daily variations of the temperature above or below the base. Further, since the mean between the maximum and minimum of any day is nearly equal to the mean temperature of the day, the difference of the mean of the maximum and minimum from the base also will give directly a fair approximation to the accumulated temperature for the day.

The following rules, however, supply a still closer approximation to the true values sought, and they have been adopted for the preparation of the table in the Weekly Weather Report. They may be applied to any other base temperature as well as to 42° F., with the slight modification of the numerical coefficients.

RULES for computing for a WEEKLY PERIOD the ACCUMULATED TEMPERATURE above or below 42° F. from the observed MAXIMA and MINIMA.

1. Obtain the mean temperature from the means of the seven observed maxima and minima by multiplying the difference between them by the proper coefficient for the month, and adding the result to the mean of the minima.

2. In obtaining the accumulated temperature four cases may occur, to which the following rules will apply :—

Conditions of Temperature.	To obtain the Accumulated Temperature.	
	Above 42° F.	Below 42° F.
If the minimum is *above* 42° F. or *equal* to 42° F.	Subtract 42° F. from the mean.	There is none.
If the minimum is *below* 42° F., but the mean for the day is *above* 42° F.	From the difference between the mean for the day and the minimum deduct the accumulated temperature below 42° F., calculated as stated in the next column.	The required quantity is the excess of 42° F. over the minimum multiplied by the coefficient 0·4.
If the mean for the day is *below* 42° F., but the maximum is *above* 42° F.	The required quantity is the excess of the maximum over 42° F. multiplied by the coefficient 0·4.	From the difference between the mean for the day and the minimum deduct the accumulated temperature above 42° F., calculated as stated in the preceding column.
If the maximum is *below* 42° F., or *equal* to 42° F.	There is none.	Subtract the mean from 42° F.

In each case the result will be the mean daily value for the week, and must be multipled by 7 in order to obtain the value for the whole week.

The coefficient varies with the duration of the period and the value of the base temperature. In the above instance the base value is 42°; when it is 32° the coefficient is 0·4; when 52° it is 0·33; and when 62° it is 0·25.

A full explanation of these rules will be found in Appendix II. to the Quarterly Weather Report for 1878.

These statistics are given for *each district* on the first page of the publication, the temperature, accumulated heat, rainfall, and sunshine values for *each station** being given on the last page.

The average values, which are used in the report for purposes of comparison, have been recomputed, those now in use being :—

For Temperature - - 20 years 1861–80
„ Rainfall - - 15 „ 1866–80

In addition to the telegraphic reports, and the returns from the self-recording observatories, weekly returns from 34 volunteer observers are used in preparing this report, the names of the observers at each station being as under—

Names of Stations.	Names of Authorities.
Alnwick Castle - - -	Lieut.-Col. F. Holland, for the Duke of Northumberland.
Arlington (N. Devon) - -	J. Carter, for Lady Chichester.
Bawtry (Hesley Hall) - -	B. I. Whitaker, F.R. Met. Soc.
Birmingham (Oscott) - -	Rev. J. W. Browne, St. Mary's College.

* The sunshine values are furnished for only a limited number of carefully selected stations, those in this list so provided are marked with an asterisk.

Names of Stations.		Names of Authorities.
Blackpool	ℳ	C. T. Ward, F.R. Met. Soc.
Brookeborough	-	Mr. Ferguson, for Sir Victor Brooke, Bt. F.L.S.
Cheadle	ℳ	J. C. Philips, F.R. Met. Soc.
Churchstoke*	ℳ	P. Wright, F.C.S., F.R. Met. Soc.
Cirencester*	-	The Royal Agricultural College.
Cullompton*	ℳ	T. Turner, J.P., F.R. Met. Soc.
Douglas (Isle of Man)*	-	A. W. Moore, F.R. Met. Soc., Cronkbourne.
Dublin	-	J. W. Moore, M.D., F.R. Met. Soc.
Foynes	-	T. J. Carey, for Lord Monteagle.
Geldeston*	-	E. T. Dowson, F.R. Met. Soc.
Hastings (St. Leonard's)*	-	H. Colborne, M.R.C.S.
Hereford	ℳ	T. A. Chapman, M.D., F.R. Met. Soc.
Hillington*	ℳ	Rev. H. E. B. Ffolkes, M.A., F.R. Met. Soc.
Kilkenny	-	H. Carlton, for the Marquis of Ormonde.
Killarney	-	Rev. G. R. Wynne.
Laudale (Loch Sunart)	-	A. Fletcher, for T. H. G. Newton, F.R. Met. Soc.
Leicester*	-	J. C. Smith, the Museum.
Llandovery	-	J. Watkins.
Llandudno*	ℳ	J. Nicol, M.D., F.R. Met. Soc.
Londonderry	-	J. Conroy, F.R. Met. Soc.
Manchester (Prestwich)	-	T. R. H. Clunn, M.D.
Markree Castle (Sligo)*	-	A. Marth, F.R.A.S., for Colonel Cooper, F.R.A.S.
Marlborough	ℳ	Rev. T. A. Preston, M.A., F.R. Met. Soc.
Newton Reigny (Penrith)*	-	T. G. Benn, F.R. Met. Soc.
Plymouth	-	J. Merrifield, LL.D., F.R.A.S.
Rothamsted	-	Rainfall by Sir J. B. Lawes, Bart., LL.D., F.R.S., and J. H. Gilbert, Ph.D., F.R.S., temperature by T. Wilson, F.R. Met. Soc.
Scarborough	ℳ	A. Rowntree, F.R. Met. Soc.
Silloth*	-	Rev. F. Redford, F.R S.E.
Southampton*	-	J. T. Cook, R.E., Ordnance Survey Office.
Strathfield Turgiss	ℳ	Rev. C. H. Griffith, F.R. Met. Soc.
Waterford (Brook Lodge)	-	C. Percival Bolton, F.R. Met. Soc.

The returns marked "ℳ" are supplied through the Royal Meteorological Society.

The report is prepared on Wednesday in every week, and is ready for sale early on Saturday morning, but the summary on its first page is sent to the "Times," "Daily News," and some other papers on Wednesday evening.

A *Quarterly Summary* of the Weekly Weather Report has been also issued as an Appendix, giving for each of the 12 districts before referred to (1) the Mean Temperature for each Quarter and for the Whole Year in each year from 1878 to 1884 inclusive, and the means for certain groups of years; (2) the Total Rainfall for the same periods; and (3) the Accumulated Temperature, Rainfall, and Bright Sunshine for the Quarter. In the Summaries for the year 1884 there are added, for each district, the values for *Rainfall* (number of rainy days and fall in inches), and *Accumulated Heat* (above and below 42° F.) during the seven years 1878–84, and *Bright Sunshine* (number of hours recorded, and percentage of possible duration), for each of the five years 1880–84. These are given for each month, and for the whole period elapsed since the commencement of the year; while in a second Appendix

similar values are given for each week in the years mentioned. To these are added, in the Preface, tables showing the total number of hours of sunshine possible in each week and month for each district, with their reciprocals.

Monthly Weather Report.

Since the commencement of 1884 a *Monthly Weather Report* has been issued, containing (1) A General Summary for the Month of the weather experienced over the United Kingdom and its neighbourhood; (2) Tables of the principal Cyclonic and Anticyclonic Systems which have passed over our area during the month; and (3) Tables of Pressure, Temperature, Hygrometric Deductions, Rainfall, Weather, and Wind experienced at a large number of stations scattered over the United Kingdom, together with remarks thereon, and illustrated by two plates. The report is, therefore, as far as possible, similar to the Quarterly Weather Report, but owing to its prompt issue, it cannot contain either the Gale Tables, or the Tables of Mean Values for the Observatories, which are found in its predecessor.

Issue of Forecasts.

Descriptions of the actual state of the weather, and forecasts *for not more than one day in advance*, are prepared at the Meteorological Office as under:—

On Week Days.

(1.) At 11 a.m. (from the morning reports), for the 24 hours ending at Noon on the day following the date of issue. This issue is intended especially for the early editions of the evening papers, for the clubs, and for exhibition at certain selected stations. See p. 10.

(2.) At 3.30 p.m. (from the morning and afternoon reports), for the day following that of issue. This set of Forecasts is not intended for general publication, but a copy is exhibited regularly at the door of the Meteorological Office.

(3.) At 8.30 p.m. (from the 6 p.m. reports), for the day following that of issue. These are now supplied gratis to any newspaper or news agency which may apply for them, and send for them regularly. A very large number of the most important papers avail themselves of this advantage.

The forecasts are made for the following districts:—

0. Scotland, North.
1. Scotland, East.
2. England, N.E.
3. England, East.
4. Midland Counties.
5. England, South
6. Scotland, West (with Isle of Man).
7. England, N.W. (with North Wales).
8. England S.W. (with South Wales).
9. Ireland, North.
10. Ireland, South.

The descriptions and forecasts are posted at the doors of the Meteorological Office, 116, Victoria Street, S.W., on week days, for the inspection of the public. Copies, or extracts from them, are communicated under the conditions stated below, but no information which is not substantially included in them can be supplied.

FORECASTS FOR PRIVATE SUBSCRIBERS.—Any person can be supplied with a copy of the 11 a.m. Forecasts, once on each week day,* on payment of a subscription of ten shillings per annum, *in addition to the cost of transmission;* the charges will therefore be, by *letter* post, 9*s.* per quarter, by *book* post, 5*s.* 9*d.*

FORECASTS FOR CLUBS.—Forecasts, drawn up at 11 a.m., for all the districts, are supplied to Clubs, for a subscription of ten shillings per annum. These are delivered free, by hand, to Clubs situated in or near Pall Mall. Special arrangements can be made for delivery at a greater distance by hand or by post.

SUBSCRIBERS FOR THE LITHOGRAPHED COPY OF THE DAILY REPORT have the 11 a.m. Forecast incorporated with their Report on each week day. The subscription for the Report is—

For delivery by hand, where feasible, £2 *per annum;*
Do. by book post £1 „

N.B.—Subscriptions must be paid in advance, and end at the usual official quarter day. The subscription for any part of an official quarter is charged as a complete quarter.

Unless otherwise arranged, all forecasts transmitted by post are sent by book post, not as letters.

INQUIRIES as to the WEATHER.

INQUIRIES PERSONALLY OR BY MESSENGER.—Any person applying at the Meteorological Office between 11 a.m. and 8 p.m. on week days, and between 6.30 p.m. and 8 p.m. on Sundays, can be supplied in writing with the latest information in the possession of the Office and with the latest forecast issued for any specified district, on payment of one shilling for each inquiry.

INQUIRIES BY LETTER.—Application may be made by letter, enclosing thirteen pence in stamps if the reply is to be *by post*, and two shillings in stamps if the reply (not exceeding twenty words) is to be *by telegraph.*

INQUIRIES BY TELEGRAPH.—Any person may obtain *by telegraph* from the Meteorological Office the latest information as to the weather in any district of the United Kingdom by payment of a fee of 3*s.* The telegram containing the inquiry must not exceed 20 words in length, and must be addressed to the

METEOROLOGICAL OFFICE,
LONDON.

Application may also be made for similar information to be sent either *by telegraph* or *post* on some future specified day.

CHECKING of FORECASTS.

In order to test the accuracy of the forecasts they have been compared carefully with the weather reported in the various districts on the days to which they referred, and the results of this checking have been already given in the Report (p. 11).

In carrying out this comparison the portions of the forecasts which referred to wind have been carefully separated from those relating to weather. The detailed results of the comparison will be found in Appendix XII., p. 83.

CHECKING of STORM WARNINGS.

The testing of the warnings is conducted in the following manner: The intelligence issued is compared with the weather experienced on

* Good Friday and Christmas Day are reckoned as Sundays.

the coasts, as indicated by the various self-recording anemometers, by the telegraphic reporters, and by several gentlemen who have volunteered to observe for the Office, and whose names will be found in Appendix XVI.

In order to render the information in the possession of the Office as to the weather experienced on our coasts still more complete, the Council have, as in preceding years, made application to the various Light-house Boards, and have obtained from them the original log-books from some of the most exposed lightships and lighthouses. They would here express their cordial thanks for the co-operation so readily granted to them by these Boards.

The result of the checking for 1884 will be found on p. 14.

The coasts are subdivided into nine districts, as will be seen in the table. Two large tracts of coast are entirely omitted: The west of Ireland from the Shannon to Malin Head, and the West of Scotland from the Mull of Cantyre to Cape Wrath. No warnings are issued to any place within the limits indicated, except to Galway, and the amount of information as to the weather received from the omitted tracts of coast is, as yet, very scanty.

It should be remembered that in analysing the reports, all observations of the wind in which the force *exceeded* 7 (a "moderate gale") or the velocity exceeded 40 miles an hour, have been quoted as instances of the occurrence of a gale; but it has not been considered that the signal was hoisted late or was hauled down too soon, unless the force of 9 (a "strong gale") or the velocity of 50 miles an hour, was reached prior to the issue of the order to hoist, or subsequent to the issue of the order to lower.

In the Summaries all cases in which the signal has been shown to be late by a single report either of force 9, or of a velocity of 50 miles an hour, have been specially noted.

APPENDIX IX.

LIST of PERSONS, PLACES, &c. to which the Daily Weather Report is supplied, free of cost.

Newspapers:

Lloyd's Shipping List. (MS. copy.)
New York Herald.
Times (1st and 2nd editions).

For Exhibition at following Seaports:

Banff.
Barrow-in-Furness.
Belfast.
Blackpool.
Bo'ness.
Boscastle.
Brighton.
Briton Ferry.
Broughty Ferry.
Buckie.
Budehaven.
Caernarvon.
Cork.
Cowes.
Cromer.
Cullercoats.
Deptford Yard.
Dover.
Dundee Harbour-master.
Exeter (2 copies).
Falmouth.
Glasson Dock.
Great Grimsby (2 copies).
Groomsport.
Hastings.
Hayle.
Holyhead.
Kingstown.
Lancaster.
Leith.
Lowestoft.
Margate.
Morecambe.
Nairn.

For Exhibition at following Seaports—cont.

Newquay.
Penarth.
Plymouth.
„ G. W. Docks.
Port Dinorwic.
Porthcawl.
Queenstown.
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APPENDIX X.

Fishery Barometers.

List of Places supplied with Fishery Barometers.

Shetland Isles.—Balta Sound, Uya Sound, Lerwick, Sandsair, Symbister, Scalloway.

Orkney Isles.—Burray. Kirkwall.

Scotland, east coast.— Stroma, Keiss, Staxigoe, Wick, Sarclet, Lybster, Dunbeath, Portmahomack, Cromarty, Avoch, Nairn, Burghead, Portessie, Port Knockie, Portsoy, Whitehills, Gardenstown, Rosehearty, Pitullie, Inverallochy, Pointlaw, Port Erroll, Findon, Portlethen, Muchals, Stonehaven, Arbroath, Broughty Ferry, St. Andrews, Crail, Cellardyke, St. Monance, Burntisland, Newhaven.

England, east coast.—Berwick, Beadnell, North Shields, South Shields, West Sunderland, Hartlepool, Staithes, Scarborough, Filey, Flamborough, Bridlington Quay, Withernsea, Hull, Lynn (2), Wells, Gorleston, Harwich, Brightlingsea, Wivenhoe, Margate, Deal (2), Kingsdown, Dover.

England, south coast.— Bognor, Portsea, Ryde and Ventnor (2) (Isle of Wight), Gorey (Jersey), Haslar Hospital, Poole, Weymouth, Portland, Budleigh-Salterton, Cawsand, Charlestown, Mevagissey, Gorranhaven, Devoran, Portscath, Penryn, Durgan, Porthallow, Falmouth, Coverack, Newlyn, Mousehole.

England, south-west coast.— St. Ives, Hayle, Padstow, Port Isaac, Boscastle, Fremington, Burnham, Highbridge, Weston-super-Mare.

Wales.—Briton Ferry, Swansea, Angle, Milford, Abersoch.

England, north-west coast.—Fleetwood, Morecambe, Maryport.

Isle of Man.—Douglas, Port St. Mary, Peel.

Scotland, south-west coast.—Port Patrick, Stranraer.

Ireland, east coast. — Cushendall, Belfast, Bangor, Groomsport, Donaghadee, Strangford, Ardglass, Carlingford, Greenore, Dundalk, Malahide, Howth, Kingstown (2), Bray.

Ireland, south coast.—Dunmore, Dungarvan, Crosshaven, Kinsale, Union Hall, Castletownsend, Baltimore, Schull, Crookhaven.

Ireland, west coast.—Port Magee, Valencia, Dingle, Tralee, Tarbert, Kilcredane, Barna, Elly Bay, Ballyglass, Ballycastle (Co. Mayo), Donegal, Tribane, Killybegs, Teelin, Portnoo, Burton Port, Bunbeg.

Ireland, north coast.—Dunfanaghy, Rathmullen, Buncrana, Greencastle, Portrush, Portstewart.

Scotland, west coast.—Tarbert, Campbeltown, Carradale, Portree (Isle of Skye), Plockton.

Hebrides, Stornoway, Cromore, Babyle, Obb, Ness.

SUMMARY of STATIONS supplied with INSTRUMENTS.

England and Wales - - - - - -	67
Scotland - - - - - - -	54
Ireland - - - - - - -	47
	168

APPENDIX XI.

TELEGRAPHIC WEATHER INTELLIGENCE.

The following stations are supplied with telegraphic information of storms, free of expense, and signal "cones" have been furnished to most of them, all further expenses attendant on the maintenance and repair of the apparatus being borne locally. The stations are situated,

81 in England and Wales, 38 in Scotland, 15 in Ireland, 3 in the Isle of Man, and 3 in the Channel Islands.

NORTH.	WEST.	SOUTH.	EAST.
SCOTLAND. EAST COAST.	ENGLAND, N.W.	ENGLAND, S.W.	ENGLAND, E.
Dunrossness.	Ramsey.	Ilfracombe.	Eyemouth.
Lerwick.	Douglas.	Barnstaple.	Berwick-on-Tweed.
Scalloway.	Castletown.	Boscastle.	Tynemouth.
Kirkwall.	Silloth.	Port Isaac.	S. Shields.
Holborn Head.	Maryport.	Newquay.	Sunderland.
Wick.	Workington.	Hayle.	Middlesborough.
Inverness.	Whitehaven.	Scilly.	Redcar.
Nairn.	Barrow.	St. Sennen.	Whitby.
Burghead.	Morecambe.	St. Just.	Filey.
Lossiemouth.	Fleetwood.	Penzance.	Bridlington Quay.
Buckie.	Blackpool.	Falmouth.	Hull.
Portsoy.	Lytham.	Pendennis.	Goole.
Banff.	Southport.	Mevagissey.	Grimsby.
Fraserburgh.	Runcorn.	Plymouth.	Boston.
Peterhead.	Liverpool.	Teignmouth.	Sutton Bridge.
Aberdeen.	ENGLAND, W.	Exmouth.	Lynn.
Stonehaven.	Connah's Quay.		Sheringham.
Montrose.	Port Penrhyn.		Cromer.
Broughty Ferry.	Holyhead.		
St. Andrews.	Port Dinorwic.		
Dundee.	Carnarvon.		
Bo'ness.	Aberystwith.	ENGLAND, S.	
Grangemouth.	Milford.		ENGLAND, S.E.
Anstruther.	Pembrey.	Guernsey.	
Pittenweem.	Swansea.	St. Helier's (Jersey).	Yarmouth.
Burntisland.	Llanelly.	Gorey (Jersey).	Southwold.
Alloa.	Briton Ferry.	Weymouth.	Ipswich.
Granton.	Porthcawl.	Poole.	Harwich.
Newhaven.	Penarth.	Cowes.	Chatham.
Leith.	Cardiff.	Ryde.	Sheerness.
Fisherrow.	Newport.	Portsmouth.	Faversham.
Dunbar.	Weston-super-Mare.	Littlehampton.	
Cockburnspath.	Burnham.	Brighton.	
		Newhaven.	
		Hastings.	
	IRELAND, E.	Rye.	
	Belfast.	Dover.	
	Donaghadee.	Margate.	
	Howth.		
FIRTH OF CLYDE.	Kingstown.		
Glasgow.	IRELAND, S. and W.		
Greenock.	New Ross.		
Rothesay.	Dunmore East.		
Campbelton.	Dungarvan.		
Girvan.	Youghal.		
Ballantrae.	Queenstown.		
	Passage.		
	Kinsale.		
	Cork.		
	Tralee.		
	Limerick.		
	Galway.		

Circular No. 717.

TELEGRAPHIC WEATHER INTELLIGENCE.

Board of Trade, February 14th, 1874.

THE Board of Trade have been informed by the Meteorological Committee that they are now prepared to re-introduce the use of Admiral FitzRoy's signals (cones and drum) with slightly modified significations, and that the change will take effect on and after 15th March 1874.

The signals to be used will consist of:—

1. Cone, point downwards for Southerly gales; S.E. round by S. to N.W.
2. Cone, point upwards for Northerly gales; N.W. round by N. to S.E.
3. Drum, *with cone*, to indicate the probable approach of a *very heavy gale* from the direction indicated by the cone.*

The drum will not be used without the cone.

The signals are to be kept hoisted *during the daylight only*, until 48 hours have elapsed from the time *the telegram was despatched*, unless countermanded. At night, lanterns may be used wherever the local authorities deem it desirable to do so, as pointed out in the explanatory pamphlet† sent herewith, copies of which are supplied for gratuitous distribution.

It will be seen from the pamphlet in question that the meaning of the signals is that an atmospherical disturbance exists (which will be explained in the telegram), and will probably, but not *necessarily*, cause a gale at the place warned, *from the direction* indicated by the signal.

The Meteorological Office will supply the canvas shapes and lanterns to such places as require them, on loan, but in all cases the local authorities must undertake the charges incidental to the hoisting of the signal, such as flagstaff and gear, oil, &c., and also to the keeping of the apparatus in repair, painting, &c., as directed by the Circular No. 278, dated 30th November 1867.

THOMAS GRAY.

APPENDIX XII.

REPORT ON THE COMPARISON OF THE FORECASTS WITH THE WEATHER SUBSEQUENTLY EXPERIENCED, for the 12 Months, April 1884 to March 1885.

The letters used have the following signification:—

a = complete success.	**c** = partial failure.
b = partial (more than half) success.	**d** = total failure.

The checking has been conducted on the same system as that employed in previous years, *i. e.*, each forecast has been considered under the separate headings of "Wind" and "Weather," but the results of the 8 p.m. Forecasts only are here published.

The first column gives the percentage of success in "Wind," the second in "Weather," and the third the average of the two.

The Summary for the whole year is given at page 11.

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* The "drum" is not in use at present.

† The "explanatory pamphlet" referred to is a circular entitled "Telegraphic Weather Intelligence" printed in large type on four pages, so as to be posted up on a board.

Districts.		April 1884. Percentages.				May 1884. Percentages.				June 1884. Percentages.			
		Wind.	Weather.	Average.	a + b.	Wind.	Weather.	Average.	a + b.	Wind.	Weather.	Average.	a + b.
Scotland, N.	a	40	47	44		61	58	60		53	50	52	
"	b	30	33	31	75	16	32	24	84	37	40	38	90
"	c	20	13	17		7	10	8		3	7	5	
"	d	10	7	8		16	0	8		7	3	5	
Scotland, E.	a	57	60	59		68	55	62		63	44	54	
"	b	20	30	25	84	19	26	22	84	17	30	23	77
"	c	13	10	11		3	19	11		13	13	13	
"	d	10	0	5		10	0	5		7	13	10	
England, N.E.	a	50	55	53		71	52	62		70	60	65	
"	b	30	28	29	82	13	25	18	80	27	20	24	89
"	c	13	10	11		6	19	12		3	7	5	
"	d	7	7	7		10	6	8		0	13	6	
England, E.	a	50	55	53		52	45	49		70	60	65	
"	b	37	31	34	87	32	29	30	79	23	27	25	90
"	c	10	14	12		16	13	15		7	3	5	
"	d	3	0	1		0	13	6		0	10	5	
Midland Cos.	a	47	68	58		65	45	55		83	50	67	
"	b	33	18	25	83	19	29	24	79	10	30	20	87
"	c	13	14	14		16	13	15		7	0	3	
"	d	7	0	3		0	13	6		0	20	10	
England, S.	a	57	62	60		61	55	58		77	50	64	
"	b	37	24	30	90	29	23	26	84	20	30	25	89
"	c	3	11	7		10	9	10		0	7	3	
"	d	3	3	3		0	13	6		3	13	8	
Scotland, W.	a	43	55	49		48	55	52		53	63	58	
"	b	17	38	28	77	23	29	26	78	27	10	19	77
"	c	27	4	15		16	16	16		17	10	13	
"	d	13	3	8		13	0	6		3	17	10	
England, N.W.	a	50	59	55		49	58	54		60	57	59	
"	b	27	28	27	82	32	23	27	81	23	20	21	80
"	c	10	10	10		13	6	10		17	3	10	
"	d	13	3	8		6	13	9		0	20	10	
England, S.W.	a	33	59	46		52	55	54		70	60	65	
"	b	33	15	24	70	26	16	21	75	20	13	17	82
"	c	17	11	14		16	10	13		7	20	13	
"	d	17	15	16		6	19	12		3	7	5	
Ireland, N.	a	27	45	36		55	65	60		47	53	50	
"	b	23	33	28	64	29	23	26	86	33	23	28	78
"	c	27	11	19		6	9	8		10	7	9	
"	d	23	11	17		10	3	6		10	17	13	
Ireland, S.	a	43	63	53		45	55	50		47	67	57	
"	b	27	30	29	82	39	32	36	86	30	13	22	79
"	c	17	7	12		6	10	8		10	3	6	
"	d	13	0	6		10	3	6		13	17	15	

Summary.

British Isles	a	45	57	51		57	54	56		63	56	60	
"	b	29	28	29	80	25	26	25	81	24	23	23	83
"	c	15	11	13		11	12	12		9	7	8	
"	d	11	4	7		7	8	7		4	14	9	

Districts.		July 1884. Percentages. Wind.	Weather.	Average.	a+b.	August 1884. Percentages. Wind.	Weather.	Average.	a+b.	September 1884. Percentages. Wind.	Weather.	Average.	a+b.
Scotland, N.	a	65	58	62	91	68	42	55	83	45	57	51	80
"	b	29	29	29		29	26	28		35	23	29	
"	c	3	7	5		0	26	13		10	13	12	
"	d	3	6	4		3	6	4		10	7	8	
Scotland, E.	a	55	55	55	93	61	55	58	87	47	60	54	79
"	b	36	39	38		33	26	29		33	17	25	
"	c	6	3	4		7	13	10		17	17	17	
"	d	3	3	3		0	6	3		3	6	4	
England, N.E.	a	52	52	52	83	65	49	57	90	48	63	53	83
"	b	29	33	31		26	39	33		33	27	30	
"	c	10	10	10		9	6	7		17	10	14	
"	d	9	6	7		0	6	3		7	0	3	
England, E.	a	71	52	62	86	57	49	53	87	57	57	57	89
"	b	20	29	24		33	35	34		37	27	32	
"	c	3	16	10		7	13	10		6	6	6	
"	d	6	3	4		3	3	3		0	10	5	
Midland Cos.	a	74	58	66	87	78	52	63	89	30	57	44	79
"	b	13	29	21		24	29	26		53	17	35	
"	c	13	7	10		3	16	10		10	16	13	
"	d	0	6	3		0	3	1		7	10	8	
England, S.	a	61	58	60	92	63	58	61	90	54	70	62	84
"	b	29	36	32		30	29	29		33	10	22	
"	c	10	6	8		7	10	9		13	17	15	
"	d	0	0	0		0	3	1		0	3	1	
Scotland, W.	a	45	61	53	86	42	42	42	81	27	54	41	65
"	b	39	26	33		40	29	39		26	23	24	
"	c	10	10	10		3	10	7		37	10	24	
"	d	6	3	4		6	19	12		10	13	11	
England, N.W.	a	55	49	52	84	58	45	52	79	40	47	44	70
"	b	32	32	32		32	23	27		23	30	26	
"	c	10	16	13		10	19	15		27	20	24	
"	d	3	3	3		0	13	6		10	3	6	
England, S.W.	a	52	55	54	86	43	30	37	72	42	60	51	75
"	b	32	32	32		37	33	35		24	23	24	
"	c	13	7	10		13	20	16		24	7	15	
"	d	3	6	4		7	17	12		10	10	10	
Ireland, N.	a	42	61	52	81	43	37	40	75	27	57	42	77
"	b	32	26	29		37	33	35		50	20	35	
"	c	16	3	9		13	13	13		17	20	19	
"	d	10	10	10		7	17	12		6	3	4	
Ireland, S.	a	32	49	41	84	33	27	30	72	38	63	51	73
"	b	42	15	48		44	40	42		27	17	22	
"	c	16	3	10		20	17	19		21	10	15	
"	d	10	3	6		3	16	9		14	10	12	

Summary.

British Isles	a	55	55	55	86	55	44	50	82	41	59	50	78
"	b	30	32	31		34	31	33		34	21	28	
"	c	10	8	9		8	15	12		18	13	15	
"	d	5	5	5		3	10	6		7	7	7	

Districts.		October 1884. Percentages. Wind.	Weather.	Average.	a+b.	November 1884. Percentages. Wind.	Weather.	Average.	a+b.	December 1884. Percentages. Wind.	Weather.	Average.	a+b.
Scotland, N.	a	40	47	44		43	64	54		35	61	48	
"	b	40	40	40	84	40	33	36	90	39	29	34	83
"	c	20	7	13		10	3	7		16	7	12	
"	d	0	6	3		7	0	3		10	3	6	
Scotland, E.	a	47	67	57		47	60	54		26	49	38	
"	b	40	23	32	89	27	23	25	79	42	33	37	75
"	c	10	3	6		26	17	21		16	13	14	
"	d	3	7	5		0	0	0		16	6	11	
England, N.E.	a	52	48	50		57	50	54		19	43	31	
"	b	29	39	34	84	37	27	32	86	55	19	37	68
"	c	6	0	3		3	20	11		16	23	19	
"	d	13	13	13		3	3	3		10	16	13	
England, E.	a	55	61	58		30	43	37		36	35	36	
"	b	32	32	32	90	40	37	38	75	32	23	32	68
"	c	3	0	2		30	17	23		16	26	21	
"	d	10	7	8		0	3	2		6	16	11	
Midland Cos.	a	45	65	55		47	44	46		32	49	41	
"	b	45	29	37	92	27	53	40	86	39	35	37	78
"	c	3	0	2		26	3	14		26	13	19	
"	d	7	6	6		0	0	0		3	3	3	
England, S.	a	42	61	52		40	50	45		39	48	44	
"	b	49	29	39	91	44	40	42	87	42	26	34	78
"	c	3	3	3		13	3	8		16	16	16	
"	d	6	7	6		3	7	5		3	10	6	
Scotland, W.	a	23	44	34		24	50	37		26	42	34	
"	b	37	23	30	64	33	20	27	64	29	36	33	67
"	c	23	13	18		40	30	35		26	3	14	
"	d	17	20	18		3	0	1		19	19	19	
England, N.W.	a	49	52	51		47	54	51		32	45	39	
"	b	29	29	29	80	17	33	25	76	39	42	40	79
"	c	16	16	16		26	7	16		16	10	13	
"	d	6	3	4		10	6	8		13	3	8	
England, S.W.	a	55	49	52		40	54	47		48	61	55	
"	b	23	42	33	85	37	33	35	82	39	29	29	84
"	c	16	6	11		13	7	10		3	6	5	
"	d	6	3	4		10	6	8		10	13	11	
Ireland, N.	a	61	48	55		30	64	47		39	61	50	
"	b	20	39	29	84	47	20	34	81	48	26	37	87
"	c	6	7	7		13	13	13		13	10	12	
"	d	13	6	9		10	3	6		0	3	1	
Ireland, S.	a	49	42	46		33	57	45		39	55	47	
"	b	32	42	37	83	40	27	34	79	32	29	31	78
"	c	3	6	4		10	16	13		19	6	12	
"	d	16	10	13		17	0	8		10	10	10	

Summary.

British Isles	a	47	53	50		40	54	47		34	50	42	
"	b	34	33	34	84	35	31	33	80	40	29	35	77
"	c	10	6	8		19	12	16		17	12	14	
"	d	9	8	8		6	3	4		9	9	9	

Districts.		January 1885. Percentages. Wind.	Weather.	Average.	a+b.	February 1885. Percentages. Wind.	Weather.	Average.	a+b.	March 1885. Percentages. Wind.	Weather.	Average.	a+b.
Scotland, N.	a	39	55	47		32	54	43		52	61	57	
"	b	32	36	34	81	39	36	38	81	29	29	29	86
"	c	16	3	10		22	10	16		16	10	13	
"	d	13	6	9		7	0	3		3	0	1	
Scotland, E.	a	32	45	39		50	64	57		52	68	60	
"	b	39	36	37	76	29	11	20	77	32	26	29	89
"	c	16	13	15		18	18	18		13	6	10	
"	d	13	6	9		3	7	5		3	0	1	
England, N.E.	a	29	49	39		43	50	47		58	61	60	
"	b	61	35	48	87	29	43	36	83	29	20	24	84
"	c	10	13	12		18	0	9		10	16	13	
"	d	0	3	1		10	7	8		3	3	3	
England, E.	a	40	39	44		36	32	34		45	58	52	
"	b	48	42	45	89	50	43	47	81	39	39	39	91
"	c	3	10	7		7	18	12		6	3	4	
"	d	0	9	4		7	7	7		10	0	5	
Midland Cos.	a	42	55	49		32	29	31		49	65	57	
"	b	45	23	34	83	36	50	43	74	39	26	33	90
"	c	13	9	11		25	7	16		6	6	6	
"	d	0	13	6		7	14	10		6	3	4	
England, S.	a	61	49	55		46	32	39		58	61	60	
"	b	29	32	31	86	32	47	40	79	32	32	32	92
"	c	10	13	11		18	14	16		0	0	0	
"	d	0	6	3		4	7	5		10	7	8	
Scotland, W.	a	26	52	39		29	64	47		39	65	52	
"	b	42	29	36	75	25	25	25	72	32	26	29	81
"	c	23	16	19		28	0	14		13	3	8	
"	d	9	3	6		18	11	14		16	6	11	
England, N.W.	a	39	52	46		32	50	41		32	62	47	
"	b	42	35	38	84	36	25	31	72	36	32	34	81
"	c	19	7	13		14	4	9		19	3	11	
"	d	0	6	3		18	21	19		13	3	8	
England, S.W.	a	52	74	63		50	39	45		55	61	58	
"	b	29	20	25	98	25	47	36	81	29	32	31	89
"	c	16	6	11		18	7	12		13	0	6	
"	d	3	0	1		7	7	7		3	7	5	
Ireland, N.	a	42	71	57		47	57	52		30	65	48	
"	b	42	20	31	88	32	29	31	83	43	26	34	82
"	c	13	6	9		7	4	5		20	6	13	
"	d	3	3	3		14	10	12		7	3	5	
Ireland, S.	a	36	65	51		54	39	47		17	49	33	
"	b	42	19	30	81	21	47	34	81	50	32	41	74
"	c	19	10	15		18	7	12		23	13	18	
"	d	3	6	4		7	7	7		10	6	8	

Summary.

British Isles	a	41	55	48		41	46	44		44	62	53	
"	b	41	30	36	84	32	37	34	78	35	29	32	85
"	c	14	10	12		18	8	13		13	6	10	
"	d	4	5	4		9	9	9		8	3	5	

Form No. 42.

APPENDIX XIII.

Atlantic Weather Report.

(Gales experienced to the westward of Longitude 45° W., and Ice and Derelict Ships seen during the whole voyage.)

Ship's Name, Captain

Date* of Lowest Barometer.		Latitude N.	Longitude W.	Gales.				Ice.	Derelict Ships.
				Change of Wind about Time of Lowest Barometer.	Greatest Force and its Direction †		Lowest Bar. Reading recorded.		
Month and Day.	Hour.				F.	D.			
		° ′	° ′						

* "Ship's time," not "Greenwich time." 0 hours = midnight, when day begins; 23 = 11 o'clock on following night, or 1 hour before midnight.

† Wind direction should be true, not magnetic; force is to be by Beaufort's scale, 0 to 12.

N.B.—When done with in the United States, will the Signal Office please send this form by post to the Secretary, Meteorological Office, 116, *Victoria Street, London, England.*

APPENDIX XIV.

LIST of STATIONS from which DAILY SYNCHRONOUS OBSERVATIONS (at 0h. 8m. p.m. G. M. T.) have been received in 1884.

Stations.	Observers.	Remarks.
ENGLAND AND WALES.		
Bolton	Rev. T. Mackereth, F.R.A.S.	—
Bradford	J. McLandsborough, F.R.A.S., F.R. Met. Soc.	—
Chatham, School of Military Engineering.	G. A. Pickles, L.-Corp., R.E.	—
Falmouth Observatory	The Staff.	—
Greenwich Observatory	The Staff, for the Astronomer Royal.	—
Guernsey	A. Collenette, F.R. Met. Soc.	—
Kew Observatory	The Staff.	—
Leicester (Museum)	J. C. Smith.	—
Liverpool Observatory (Bidston).	J. Hartnup, Jun.	—
Oxford, Radcliffe Obs.	The Staff.	—
Plymouth	J. Merrifield, LL.D., F.R.A.S.	—
Silloth	Rev. F. Redford, M.A., F.R.S.E.	—
Stonyhurst Observatory	The Staff.	—
SCOTLAND.		
Aberdeen Observatory	The Staff.	—
Glasgow Observatory	The Staff.	—
Orkneys (Sandwick Manse).	Rev. C. Clouston, LL.D.	—
IRELAND.		
Armagh Observatory	Dr. J. L. E. Dreyer.	—
Galway, Queen's College	M. J. O'Donoghue.	—
Valencia Observatory	The Staff.	—
BRITISH COLONIES, POSSESSIONS, &c.		
Barbados, W. I.	Surgeon-Maj. in charge.	—
Gibraltar	Surgeon Gen. in charge.	—
Malta	A. King.	—
Nassau (Bahamas)	C. L. Dunscombe.	—
Natal	Surgeon-Maj. in charge.	—
Scutari, British Cemetery	Serg. W. H. Lyne, R.E.	—
Sierra Leone	Surgeon-Maj. in charge.	—

SUMMARY.

—	—
England and Wales	13
Scotland	3
Ireland	3
British Colonies and Possessions	7
Total	26

APPENDIX XV.

METHODS FOLLOWED IN DEALING WITH METEOROLOGICAL RETURNS FROM LAND STATIONS IN THE UNITED KINGDOM.

These stations are of five classes, as stated on page 18.

I.—*Observatories continuously observing all the Meteorological Elements.*

Returns from observatories. Hourly measurements of the curves obtained from the self-recording instruments at the observatories of the Office are made by the observers at each station, on printed forms supplied for the purpose, which, together with the curves, are forwarded to the Office weekly. They comprise measurements of the barograms, of the dry and wet-bulb thermograms, of the anemograms, and of Beckley's rain-gauge curves.

Examination of returns. The measurements are subjected to a careful examination in order to ensure as far as possible their accuracy, and the regulations which have been adopted to secure this end will be found fully detailed in the Report of the Office for 1868. They comprise rules for the guidance of observers, as well as of the assistants charged with the examination of the work at the Office. Attention need be called here to only two of these rules, viz.: (*a*) the use of subsidiary sheets on which are entered the results of a second set of measurements of the curves, made after, and quite independently of, the first set and with a different scale the two sets of measures being afterwards compared together, and any differences found inquired into and set right; and (*b*) the re-measurements of the curve made by the assistants at the Meteorological Office, and which always amount to 40, and in doubtful cases to many more, per month for each element.

Results of examination and report to Council. The attention of the observers is always drawn to such errors as may be detected, and to any failures in the continuity of the curves arising from failure of the light, stoppage of the clock, defective photography, faulty action of the wet-bulb thermometer, &c.; a report containing the results of the examination of each Observatory being also submitted to the Council each month and printed in their minutes. The curves and tabulations are eventually bound and stored in the Office.

Chart plates. In the more recent numbers of the Quarterly Weather Report (for 1876) plates of charts are issued showing the conditions of barometrical pressure and wind for Western Europe for 8 a.m. and 6 p.m. each day, each plate containing 36 charts.

General supervision of observatory work. In connexion with this work should be mentioned the general watch which has to be kept over the working of the observatories and of the instruments, not only to secure uniformity amongst them and observance of rules, but also to guard against small changes which are liable to occur at certain times, especially with the thermographs, and which may affect the scale-values of the instrument or the datum lines used for the tabulation of the curves. About twice a year this work calls for special examination, entailing some considerable time and occasionally the engraving of new scales for measuring the curves.

Harmonic analyser. The photographic curves are also used in the harmonic analyser; they require little or no preparation for this purpose beyond that necessary for their reduction for the Quarterly Weather Report.

METHOD OF DEALING WITH THE NUMERICAL RESULTS FROM THE SELF-RECORDING OBSERVATORIES.

Interpolations. In dealing with the tabulations the first step is to go over the sheets and fill up by interpolation, wherever possible, any gaps or breaks in the continuity of the record.

Means. The record having been made as complete as possible, the daily, five-daily, and monthly means of the barometer and of the dry-bulb and wet-bulb thermometers are obtained by addition.

Vapour tension. The hourly vapour tension is then computed by an expansion of Glaisher's Hygrometrical Tables, prepared in the Office, and the work independently checked.

Hourly Readings. A copy is next prepared of the above-mentioned hourly measurements of the barometer, dry-bulb and wet-bulb thermometers, wind and rain curves, and of the computed values of vapour tension. To these are added the daily means of the three first-mentioned elements, the extremes and daily range of pressure and temperature, and the daily totals of rainfall, and the whole series is printed and published under the title of "Hourly Readings from the Self-recording Instruments "at the Seven Observatories under the Meteorological Council."

To ensure accuracy the sheets are read over in proof with the originals. The interpolated readings are printed in *italic* type, but no distinguishing mark is affixed to means which are partly based on them. When the gap in the record is too long to be dealt with by an interpolation of the missing hourly readings, the mean for the day is obtained by an interpolation from the adjacent daily means, and the result thus obtained is printed as an approximation.

Tables for the Quarterly Weather Report. The five-daily, monthly, and annual means, together with the absolute extremes of pressure and temperature for each month, have hitherto been published as an appendix to the Quarterly Weather Report, but in future, beginning with the volume for 1881, these values will be printed at the end of the "Hourly Readings." As before the tables will be repeated in French measures.

Gale tables. The gale tables printed in the text of the Quarterly Weather Report, which show the extent, duration, and degree of severity of all the stronger gales, are prepared from the tabulations of the anemograms received from the self-recording observatories, together with those received from the six extra anemographic stations.

II.—*Anemographic Stations at which the Wind is recorded continuously.*

The anemograms received from the six stations enumerated on page 95 are regularly examined and tabulated in the Office, and the sheets bound up in volumes. Besides special inquiries on legal and other points that from time to time arise, and in which these documents are of the highest importance, the tabulations are always employed in the preparation of the chronicle and gale tables for the Quarterly Weather Report. They are also regularly used in the checking of the storm warnings issued by the Office.

III.—*Method followed with regard to the Returns from Land Stations of the Second Order.*

Origin and progress of system. Ever since the year 1866 returns of more or less completeness have been received from land stations in the United Kingdom. In that year there was only one station, but by 1871 the number had increased to

15, and five years later to 49, including 14 stations belonging to the Royal Meteorological Society, copies of the returns from which were sent to the Office under a special arrangement with the Society.

At the end of the present year the total number of stations is 68, including 15 belonging to the Royal Meteorological Society and 5 belonging to the Scottish Meteorological Society.

This number is exclusive of the self-recording observatories, and of the anemographic stations, but it includes several from which only very scanty information is received.

The stations are distributed as follows: 38 in England, 4 in Wales, 10 in Scotland, and 16 in Ireland.

The returns are received at the Office monthly, and are duly entered and stored.

Publication on Form A.

The publication of the returns is carried out in the following way: For a certain number of stations the observations of pressure, temperature, wind, cloud amount, and weather at 9 a.m. and 9 p.m. each day, together with the computed vapour tension and relative humidity at those hours, and the daily maxima and minima of temperature, and daily rainfall, are published *in extenso* on the Form, A., proposed by the Permanent Committee of the First International Meteorological Congress at Vienna in 1874, and adopted for international use by the Second International Meteorological Congress at Rome in 1879.

The Permanent Committee assigned an inferior limit to the number of stations from which returns should be published *in extenso*, varying from two for Belgium to 100 for Russia in Asia, the number in the case of the United Kingdom being 15. In 1875, when the systematic publication of returns from Stations of the Second Order began, only nine British stations were available, but this number has steadily grown, until for 1880 returns from 33 stations were published on the A. Form. Though this list could be extended if desired, it has been thought better to curtail it somewhat on account of the size of the publication. The volume for 1881, now passing through the press, will therefore contain returns, *in extenso*, from only 30 stations.

Additions to the list for publication.

Care is taken in adding to the list for publication to see, first, that the station is satisfactory as regards its instruments, their exposure, &c.; secondly, that the returns bear internal evidence of accuracy and care in their preparation; and thirdly, that the district represented by the station is one for which information is needed.

Examination of the returns.

All the returns selected for publication on Form A. are carefully examined and compared before being copied for the printer. The reduction of all the barometer readings to 32° Faht. at mean sea level, is checked, and the corrected readings are then compared with the isobars on the Daily Weather Charts and readings at neighbouring stations for the day, allowance being made for any difference in time and the corresponding change in barometric pressure.

The correction of the readings of the dry-bulb and damp-bulb thermometers is checked, and the maxima and minima temperatures are compared with the dry-bulb thermometer readings over the same periods to ensure that they are the extreme temperatures registered.

The computed values of the vapour tension and the relative humidity are examined from the tables. The cloud amount is compared with the weather at the time of observation, and finally, the sums and means are all re-calculated.

Doubtful readings.

If any readings are doubtful, reference is made through the observer to the original observation book. If no fresh light is thrown on the question by this means, and if on reconsideration the reading still appears to be wrong, it is rejected, and the probable reading is inserted

in its place, but printed in different type as an interpolation. These probable readings are used in obtaining the monthly means. Similarly, if from any cause a set of readings has been omitted, the gap is filled by an interpolation, and the probable values are printed in different type.

Apparent errors, or discrepancies, in the working on the sheet are also referred to the observer before alteration.

Unpunctual observations.

The observations are taken at 9 a.m. and 9 p.m. local time each day. It sometimes happens, however, that strict punctuality cannot be observed. In such cases, if the difference in time does not exceed 30 minutes, the observations are, in most cases, printed without alteration. When the difference exceeds 15 minutes, a note is inserted in the remarks showing the exact time of observation. If the difference in time is more than half-an-hour, the readings are usually rejected and an interpolation made.

Besides this publication in full, the monthly means of the various elements, together with summaries of the wind direction and of the weather, are published on the Form, B., also devised by the Permanent Committee of the Vienna Congress, and adopted by the Roman Congress.

Returns from six stations were published in this manner for the year 1873, and from nine stations for the year 1874. In 1875 the list included the names of 26 stations. This number has grown to 45 for the year 1881, and might be even further increased.

All the stations, returns from which are published *in extenso* on Form A., are included in the Form B. list. But this list also includes others, either not quite so good, not so representative, or not so long established. The method of preparation is in the main the same as in the case of the Form A. But the summaries of wind and weather are specially prepared for this publication. For wind, the summary shows the number of *observations* at 9 a.m. and 9 p.m. under each of the bi-quadrantal points N., N.E., E., &c., the observations under intermediate points being thrown alternately forward and backward. For weather, the summary gives the number of *days* of rain, snow, hail, thunderstorm, clear sky, overcast, and gale. The days of clear sky and overcast are those when the mean of the cloud amounts at 9 a.m. and 9 p.m. are less than 2, and more than 8 respectively. The days of gale are those when force 7 or upwards, by Beaufort scale, is recorded.

New stations.

When an application for the adoption of a new station is received, a schedule is forwarded to the observer containing a series of questions as to the outfit of the station, the exposure of the instruments, and the influence likely to be exerted on their indications by surrounding objects, such as houses and trees. Only mercurial barometers are accepted, and only such as have been duly verified. All thermometers must have been tested at Kew. A plan of the station, showing the positions of the instruments with regard to neighbouring objects is also required.

On the return of this schedule the answers are considered, and, where necessary, alterations are advised.

If, however, the existing arrangements are satisfactory, tables for reducing the barometer readings to 32° Fahrenheit at mean sea level are prepared and duplicates sent to the observer, together with a set of Hygrometrical Tables, and a copy of "Instructions in the Use of Meteorological Instruments."

The first returns are compared and examined with special care, and a report of the result of the examination is forwarded to the observer, with instructions how best to complete and perfect the returns.

Sunshine records.

The daily records of sunshine which are now received from 29 Stations in the British Islands are examined generally to guard against accidental changes in the adjustment of the instrument. After their

receipt has been acknowledged, the cards are duly stamped and dated and then stored in the Office.

A tabulation of these curves is published as part of the Weekly Weather Report, mentioned in Appendix VIII., and for those stations which are also Stations of the Second Order the monthly totals of bright sunshine in hours, together with the percentage of its possible duration, is published as Part IV. of "Returns from Stations of the Second Order."

Inspection. The Stations of the Second Order are regularly inspected, the attention of the inspector being directed by the Office to any special point which may require elucidation.

IV.—*Telegraphic Reporting Stations.*

Full particulars relating to these stations, the information received from them, and the method of dealing with that information, will be found in Appendix VIII. A paragraph in that Appendix (p. 71) explains the use that is made of the monthly schedules sent in by the observers.

V.—*Extra Stations.*

No returns from Stations of the Fifth Class are published by the Office, but some of them are regularly used in the checking of the storm-warnings, and all are available for any special investigation that may be taken up.

The rainfall values at these stations are, however, copied and supplied to Mr. Symons, F.R.S., for publication in "British Rainfall."

APPENDIX XVI.

List of Documents relating to the Land Meteorology of the British Islands, received during the Year ending March 31st, 1885.

Stations.	Observers.	Nature of Information received.	Notes.
I. †Valencia	J. E. Cullum	Continuous records of pressure, temperature, wind, sunshine, and rain, with notes on the weather.	
†Aberdeen	Prof. C. Niven, M.A., F.R.S.		
†Falmouth	E. Kitto, F.R. Met. Soc.		
Stonyhurst	Rev. S. J. Perry, F.R.S.		
†Kew	G. M. Whipple, B.Sc., F.R.A.S., F.R. Met. Soc.		
II. †Armagh	J. L. E. Dreyer, Ph.D., F.R.A.S.	Continuous record of wind, rainfall, and sunshine.	
†Alnwick Castle	Lt.-Col. F. Holland, for the Duke of Northumberland.	Continuous record of wind (direction and velocity).	
†Holyhead	Hugh Williams, C.E.	,, ,,	
†Sandwick	The late Rev. C. Clouston, LL.D., and Miss Clouston.	,, ,, and sunshine.	
†Seaham	G. H. Aird	,, ,,	
†Scilly	W. Thomas	,, ,,	
†Yarmouth	G. T. Watson	,, ,,	
†Kilkenny Castle	The Marquis of Ormonde	Continuous record of pressure.	
Waterford	The Harbour Authorities	,, ,,	
III. †Armagh*	J. L. E. Dreyer, Ph.D., F.R.A.S.	Regular observations at 9 a.m. and 9 p.m. of pressure, temperature, wind, cloud and weather, with the daily maxima and minima of temperature, and rainfall, and remarks on the weather generally.	
†Aysgarth	Rev. Fenwick W. Stow, M.A., F.R. Met. Soc.		
Babbacombe	E. E. Glyde, F.R. Met. Soc.		
†Braemar	James Aitken, J.P., F.R. Met. Soc.		
Buxton	E. J. Sykes, M.B., F.R.A.S., F.R. Met. Soc.		
Carmarthen	G. J. Hearder, M.D.		
†Chatham	Corpl. Pickles, and W. Skipper for Instructor in Surveying.		
Cheadle	J. C. Philips, Esq.		
Cheltenham	R. Tyrer, B.A., F.R. Met. Soc.		
Churchstoke*	Philip Wright, F.C.S., F.R. Met. Soc.		

* The stations so marked supply sunshine records.

LIST OF DOCUMENTS—*continued.*

Stations.	Observers.	Nature of Information received.	Notes.
†Colebrooke	W. Ferguson, for Sir Victor Brooke, Bt., F.L.S.		
†Douglas, Isle of Man*	A. W. Moore, M.A., J.P., F.R. Met. Soc.		
†Dublin (Botanic Gardens, Glasnevin).	F. W. Moore, Esq.		
†Dublin (City)	J. W. Moore, M.D., F.R. Met. Soc.		
†Dublin (Phœnix Park)*	Maj. J. C. Macpherson, R.E., Ordnance Survey		
†Dundee	W. Ross McKelvie, Esq.		
†Dunrobin Castle	D. Melville		
†Geldeston (Suffolk)*	E. T. Dowson, F.R. Met. Soc.		
†Glenalmond	W. Bezant Lowe, M.A., and Rev. A. H. S. Pattrick, M.A.		
Harestock, Hants	Lt. Col. H. S. Knight, F.R. Met. Soc.		From July 1884.
Hillington*	Rev. H. E. B. Ffolkes, M.A., F.R. Met. Soc.	Regular observations at 9 a.m. and 9 p.m. of pressure, temperature, wind, cloud and weather, with the daily maxima and minima of temperature, and rainfall, and remarks on the weather generally.	
†Jersey (St. Aubin's)*	J. E. Vibert, M.A.		
Killarney	Rev. G. R. Wynne, M.A., F.R. Met. Soc.		
†Laudale (Argyleshire)	A. Fletcher, for T. H. G. Newton, M.A., J.P., F.R. Met. Soc.		
Llandudno*	J. Nicol, M.D., J.P., F.R. Met. Soc.		
†Leicester*	J. C. Smith, for Museum Authorities		
†Londonderry	J. Conroy, F.R. Met. Soc.		
Margate	J. Stokes, F.R. Met. Soc.		
†Markree Castle, Sligo*	A. Marth, F.R.A.S., for Col. Cooper, F.R.A.S.		
Marlborough	Rev. T. A. Preston, M.A., F.R. Met. Soc.		
†Newton Reigny (Penrith).*	T. G. Benn, F.R. Met. Soc.		
†Parsonstown*	George Phillips and Benj. Budds, for the Earl of Rosse, F.R.S.		
†Peel, Isle of Man	T. H. Davis, F.R. Met. Soc.		

LIST OF DOCUMENTS—*continued.*

Stations.	Observers.	Nature of Information received.	Notes.
† Pinmore - -	Peter Donald - - - - -	Regular observations at 9 a.m. and 9 p.m. of pressure, temperature, wind, cloud and weather, with the daily maxima and minima of temperature, and rainfall, and remarks on weather generally.	
† Prestwich - -	T. R. H. Clunn, M.D. - - - -		
† Rothesay - -	James Kay, Esq. - - - -		
† Sandwick* - -	The late Rev. C. Clouston, LL.D., and Miss Clouston.		
Scaleby - -	R. A. Allison, F.R. Met. Soc. - - -		
Scarborough - -	Allan Rowntree, F.R. Met. Soc. - -		
† Seaham - -	G. H. Aird - - - - -		
† Southampton* -	J. T. Cook, R.E., for Director General of the Ordnance Survey.		
† Stokesay - -	Miss M. A. Digges La Touche - -		
† Stonyhurst - -	Rev. S. J. Perry, F.R.S. - - -		
Strathfield Turgiss -	Rev. C. H. Griffith, B.D., F.R. Met. Soc. -	- - - - - -	Till June 1884.
† St. David's, Pembroke	W. P. Propert, LL.D., F.G.S., F.R. Met. Soc.		
† St. Leonards* -	H. Colborne, M.R.C.S. - - -		
† Totnes - -	T. H. Edmunds, F.R. Met. Soc. - -		
Uppingham - -	Rev. G. H. Mullins, M.A., F.R. Met. Soc. -		
Wakefield - -	H. Clarke, L.R.C.P., F.S.S., F.R. Met. Soc. -		
† Ware, Herts - -	Rev. B. Ward - - - - -		
† York* - -	H. M. Platnauer, Esq. - - - -		
IV. The Telegraphic Stations, see List on p. 47. - - - -		Regular observations twice (and in some cases three times) daily of pressure, temperature, wind, weather, and sea disturbance.	
V. Baltimore - -	J. Halsey - - - - -	Pressure, temp., wind, and weather, once daily.	
Castletownsend -	Lieut. T. W. Cobb, R.N. - - -	Pressure and temp. four times daily, and wind twice daily.	
Crookhaven - -	" " - - - -		
Crosshaven - -	J. W. Bridle - - - - -	Pressure, temperature, and wind, twice daily.	
† Cooper's Hill (Egham)	Prof. H. McLeod, F.R.S. - - -	Full return for 9 a.m. and 3 p.m.	

* The stations so marked supply sunshine records.

LIST OF DOCUMENTS—*continued.*

Stations.	Observers.	Nature of Information received.	Notes.
Ennis	J. Hill, C.E., F.R. Met. Soc.	Daily rainfall.	
Gorleston, Norfolk	R. C. J. Day	Pressure and wind twice daily.	
†Harpenden	T. Wilson, F.R. Met. Soc.	Pressure, temperature, and wind, twice daily, with rainfall.	
Haslar	G. Coppen	Pressure and temperature four times daily.	
†Llandovery	J. Watkins, F.R. Met. Soc.	Daily rainfall.	
Rugby	C. H. Hodges, M.A.	Full set of 9 a.m. observations with 9 p.m. temperatures.	
†Saffron Walden	J. G. Bellingham	Pressure and temperature twice daily, with a.m. wind and rainfall.	
Schull	Lieut. T. W. Cobb, R.N.	Pressure, temperature, and wind twice daily.	
†Sheffield	W. F. Cooper, Esq.	Full returns for 8 a.m. and 11 p.m.	Till June 1884.
†Sheffield (Weston Park)	Elijah Howarth, Esq.	Pressure, temperature, and wind, twice daily.	
Stamford (Ketton Hall)	Fred. Coventry, F.R. Met. Soc.	Full monthly summary.	
Symbester, Shetland	J. Bruce, Esq.	Pressure and temperature twice daily.	
Tarbert (Harris)	Donald Bethune, for the late Sir E. Scott, Bt.	Full returns for 9 a.m. and 6 p.m.	
Union Hall	Lieut. T. W. Cobb, R.N.	Pressure, temperature, and wind, twice daily.	

NOTE.—The Stations marked "𝔐" belong to the Royal Meteorological Society; those marked "𝔖" belong to the Scottish Meteorological Society; those marked thus † have been inspected during the year.

APPENDIX XVII.

ACCESSIONS TO THE LIBRARY DURING THE YEAR ENDING 31ST MARCH 1885.

A—AGRICULTURE AND BOTANY.

* || **Becquerel, [A. C.]**—Mémoire sur les forêts et leur influence climatérique. Lu le 22 mai 1865. 148 pp. 4°. [*Mém. Acad. Sc., Paris*, XXXV., 1866, *p.* 371.]

Commissioner of Agriculture, Washington. — Report . . . for the year 1883. 496 pp., with plates, 8°. Washington, 1883.

|| **Stellwaag, A.**—Untersuchungen über die Temperaturerhöhung verschiedener Bodenconstituenten und Bodenarten bei Condensation von flüssigem und dampfförmigem Wasser, sowie von Gasen. 19 pp. 8°. (*Forschungen auf dem Geb. Agrik.-phys., Heidelberg. Bd.* v., *Heft* 3/4, *p.* 210.)

Ufficio centrale di Meteorologia, Roma. — Rivista Meteorico-Agraria. Anno V., 1884, Nos. 1–36. 1a. 8°. (Roma, 1884–85.)

|| **Wollny, E.**—Beiträge zur Frage des Einflusses des Klimas und der Witterung auf den Kohlensäuregehalt der Bodenluft. 18 pp. 8°. (*Forschungen auf dem Geb. Agrik.-phys., Heidelberg. Bd.* v., *Heft.* 3/4, *p.* 299.)

|| ———.—Bericht über die Verhandlungen und Ergebnisse der internationalen Conferenz für land- und forstwirthschaftliche Meteorologie, abgehalten in Wien in den Tagen vom 6—9 September 1880. Aus den Sitzungsprotokollen zusammengestellt und mit Bemerkungen versehen. 31 pp. 8°. (*Forschungen auf dem Geb. Agrik.-phys., Heidelberg. Bd.* iv., *Heft* 3/4.)

* ———.—Der Einfluss der Pflanzendecke und Beschattung auf die physikalischen Eigenschaften und die Fruchtbarkeit des Bodens. vi. + 197 pp., 10 plates, 1a. 8°. Berlin, 1877.

|| ———.—Die Hochwasserschäden und deren Verhütung in Rücksicht auf die Bodenkultur. 37 pp. 8°. (*Forschungen auf dem Geb. Agrik.-phys., Heidelberg. Bd.* vi., *Heft* 3/4.)

|| ———.—Ueber die Thätigkeit niederer Organismen in Boden. Vortrag, gehalten am 30 Juni 1883 auf der hygienischen Austellung in Berlin von Dr. E. Wollny. 26 pp. 8°. Braunschweig, 1883. (*Deutsch. Vierteljahrsschr. für öffentliche Gesundheitspflege.*)

|| ———.—Untersuchungen über den Einfluss der Exposition auf die Erwärmung des Bodens. 32 pp. 8°. (*Forschungen auf dem Geb. Agrik.-phys., Heidelberg. Bd.* i., *Heft* 4.)

|| ———.—Untersuchungen über den Einfluss des Wassers auf die Bodentemperatur. 44 pp., 2 plates, 8°. (*Forschungen auf dem Geb. Agrik.-phys., Heidelberg. Bd.* iv., *Heft* 3/4.)

|| ———.—Untersuchungen über den Einfluss der Exposition des Bodens auf dessen Feuchtigkeitsverhältnisse. 12 pp. 8°. (*Forschungen auf dem Geb. Agrik.-phys., Heidelberg, Bd.* vi., *Heft* 5.)

|| ———.—Untersuchungen über den Einfluss der Pflanzendecke und der Beschattung auf die physikalischen Eigenschaften des Bodens. Erste Mittheilung. 60 pp., 2 plates, 8°. (*Forschungen auf dem Geb. Agrik.-phys., Heidelberg. Bd.* vi., *Heft* 3/4.)

|| ———.—Untersuchungen über den Einfluss des Bodens und der landwirthschaftlichen Kulturen auf die Temperatur- und Feuchtigkeitsverhältnisse der atmosphärischen Luft. Erste Mittheilung. 25 pp. 8°. (*Forschungen auf dem Geb. Agrik.-phys., Heidelberg. Bd.* vii., *Heft.* 1/3, *p.* 209.)

|| ———.—Untersuchungen über die Wasserverbrauchsmengen der landwirthschaftlichen Kulturpflanzen in Rücksicht auf die agrarmeteorologischen Verhältnisse. 28 pp. 8°. (*Forschungen auf dem Geb. Agrik.-phys., Heidelberg, Bd.* iv., *Heft.* 1/2.)

NOTE.—Books marked * have been acquired by purchase; the others are donations from institutions, societies, or authors. Those marked || are excerpt papers, extra copies of which have been separately printed.

In some cases additional publications have been received besides those specified, but only completed volumes or years are given here.

B—ASTRONOMY.

Billotti, L.—Teoria degli stromenti ottici con applicazioni ai telescopi ed alla fotografia celeste. (Pubbl. R. Osserv. di Brera in Milano, N. xxv.) xx. + 237 pp., 7 plates, sm. f°. Milano, 1883.

Copeland, R.—An account of some recent astronomical experiments at high elevations in the Andes. 39 pp. 4°. Dublin, 1884. (*Copernicus, vol.* 3, 1883, *p.* 193.)

|| **(D[reyer], J. L. E.)**—Observatory. 8 pp. 4°. (*Encyclop. Brit., 9th ed.*)

K. K. Sternwarte zu Prag.—Astronomische, magnetische und meteorologische Beobachtungen an der k. k. Sternwarte zu Prag im Jahre 1883. Auf öffentliche Kosten herausgegeben von **L. Weinek.** 44 Jahrg. xix. + 56 pp., 1 plate, la. 4°. Prag, s.a.

Oppolzer, T. von.—Über den Zusammenhang der Refraction mit der Temperaturvertheilung in der Atmosphäre. Vortrag gehalten in der Festsitzung, welche die meteorologische und die geographische Gesellschaft zu Ehren der in Wien versammelten Polarcommission am 21 April 1884 veranstaltet haben. 14 pp., la. 8°. Wien, 1884. (*Beilage zum Maiheft* 1884 *der Zeitschr. Oesterr. Gesellsch. Meteor.*)

Royal Astronomical Society, London. — Memoirs. Vol. xlviii., Part I., 1884. 1 vol. with plates, 4°. London, 1884.

———.—Monthly Notices . . . containing papers, abstracts of papers, and reports of the proceedings of the Society, from November 1883 to November 1884. Vol. xliv., with plates, 8°. London, 1884.

Royal Observatory, Greenwich.—Report of the Astronomer Royal to the Board of Visitors of the Royal Observatory, Greenwich, read at the annual visitation of the Royal Observatory, 1884, June 7. (By **W. H. M. Christie.**) 15 pp. la. 4°. [London, 1884.]

C—ATMOSPHERIC PRESSURE.

|| **[Blanford, H. F.]**—[On the autographic trace of the Calcutta barograph on the days of 26th—30th August, 1883, showing the effects of the eruption of Krakatoa.] 3 pp., 1 plate, 8°. (*Proc. Asiat. Soc. Bengal,* 1884. *Mch.*)

|| **Denza, F.**—Confronti di barometri. 16 pp., la. 8°. (*Suppl. Meteor. Ital.,* 1869.)

———.—Studi sui barometri normali dell' Osservatorio centrale di Moncalieri con alcuni cenni sui termometri normali dell' Osservatorio medesimo. 60 pp, sm. 8°. Torino, 1881.

———.—Studi sui barometri normali dell' Osservatorio centrale di Moncalieri. Nota seconda. 28 pp., sm. 8°. Torino, 1883.

|| **Paul, H. M.**—Barometric waves of very short period. 11 pp. la. 8°. Detroit, [1884]. (*Amer. Meteor. Journ.*, I., *No.* 1, *p.* 17.)

|| ———.—Electric potential and gaseous pressure. 4 pp. la. 8°. Detroit, [1884]. (*Amer. Meteor. Journ.*, I., 1884, *Aug., p.* 150.)

|| **Ragona, D.**—Onde atmosferiche prodotte dalla eruzione del Krakatoa in Agosto 1883. 7 pp., 2 plates, sm. f°. Torino, 1884. [*Boll. mensuale Soc. meteor. ital. Serie* ii., *vol.* iv., *p.* 49.]

|| **Rykatchew, —.**—Note sur les ondes atmosphériques produites par l'éruption de Krakatoa. 21 pp., 1 plate, 8°. (*Mél. Phys. et Chim., St. Petersburg,* xii., *p.* 167.)

|| **Schiaparelli, E. G.**—Osservazioni fatte a Milano sopra il passaggio delle onde atmosferiche prodotte dall' eruzione dell vulcano Krakatoa nello Stretto della Sonda. 13 pp., 1 plate, la. 8°. (Milan, 1884.) (*Rend. R. Ist. Lombardo, Serie* II., *vol.* xvii., *fasc.* v.)

|| **Scott, R. H.**—Note on a series of barometrical disturbances which passed over Europe between the 27th and the 31st of August, 1883. Note on the foregoing Paper by Lieut.-General **R. Strachey.** 13 pp., 1 plate, 8°. (*Proc. R. Soc.*, xxxvi., 1883, *p.* 139.)

D—AURORA.

|| **Denza, F.**—Le aurore polari in Italia nell' anno 1882. Nota prima. L'aurora polare del 16–17 Aprile 1882. 22 pp., la. 8°. Torino, 1883. (*Atti R. Accad. Sc. Torino,* xviii., 1883.)

|| **Denza, F.**—Le aurore polari in Italia nell' anno 1882. Nota seconda. L'aurora polare del 19–20 Aprile 1882. 15 pp. la. 8°. Torino, 1883. (*Atti R. Accad. Sc. Torino*, xviii., 1883.)

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* **Hellmann, G.**—Repertorium der deutschen Meteorologie. Leistungen der Deutschen in Schriften, Erfindungen und Beobachtungen auf dem Gebiete der Meteorologie und des Erdmagnetismus von den ältesten Zeiten bis zum Schlusse des Jahres 1881. xxii. + 966 pp., 2 plates, la. 8°. Leipzig, 1883.

F—CLIMATE AND HYGIENE.

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Doering, O.—Ideas sobre una exploracion sistemática del clima de la provincia de Córdoba sin instrumentos. Conferencia pública dada en el Instituto Geográfico Argentino, Seccion Córdoba, el 17 de Agosto de 1883. 12 pp. 8°. Córdoba, 1883.

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* **International Health Exhibition, London, 1884.**—Meteorology in relation to Health. Conferences by the Royal Meteorological Society, Thursday and Friday, July 17 and 18. Some relations of meteorological phenomena to health. (By **J. W. Tripe.**) English climatological stations. (By **G. J. Symons.**) The Equinoctial gales—do they occur in the British Isles? (By **R. H. Scott.**) Some occasional winds and their influence on health. (By **W. Marriott.**) Cumulative temperature. (By **R. H. Scott.**) 72 pp., 3 plates, 8°. London, 1884.

|| **Liais, E.**—Influence de la mer sur les climats, ou résultats des observations météorologiques faites à Cherbourg en 1848, 1849, 1850, 1851. 70 pp. 8°. Paris, 1860. (*Mém. Soc. Imp. Sc. nat. Cherbourg*, vii.)

|| **Mohn, H.**—Klima von Norwegen. Luftdruck und Temperatur. 10 pp., 1 plate, la. 8°. (*Zeitschr. oesterr. Gesellsch. Meteor., Wien*, 1884, *April*, *p.* 145.)

* **Morris, M.**—The book of health. Edited by M. Morris. xi. + 1079 pp. la. 8°. London, 1883.

New South Wales.—Physical geography and climate. 33 pp., 3 plates, la. 8°. (Sydney, 1884.)

|| **Physiographical Commission of the I. R. Academy of Science at Cracow.**—Materials for Galician climatology, collected by the meteorological section . . . 1883. 308 pp. la. 8°. Cracow, 1884. (*Extract Rep. Physiogr. Comm.*)

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* **Ramsay, A.**—A bibliography, guide and index to climate. 449 pp. 8°. London, 1884.

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|| **Woeikof, A.**—Klima von Ostsibirien. 19 pp. sm. f°. (*Meteor. Zeitschr. deutsch. meteor. Gesellsch.*, I., 1884, *p.* 443.)

G—EARTHQUAKES.

* **Rockwood, C. G., Jr.**—Notices of recent American earthquakes. No. 9. 5 pp. 8°. [*Amer. Journ. Sc.*, 3rd *series*, xix., 1880, *p.* 295.]

H—ELECTRICITY AND MAGNETISM.

|| **Bezold, W. von.**—Ueber zündende Blitze im Königreich Bayern während des Zeitraumes 1833 bis 1882. 60 pp., 1 plate, 4°. München, 1884. (*Abhandl. k. bayer. Akad. Wissensch.*, ii. *Cl.*, xv. *Bd.*, i. *Abth.*)

|| **Brioschi, F., e Angeletti, F.**—Determinazioni assolute della declinazione magnetica nel R. Osservatorio di Capodimonte. Prima comunicazione del Direttore **A. de Gasparis.** Agosto-Dicembre 1883. 9 pp. la 4°. Napoli, 1884. (*Rend. R. Accad. Sc. Fis. e Mat. Napoli, Fasc.* 3°, *Marzo*, 1884.)

Colonial Secretary's Office, Hongkong.—[Observations of the Dip of the magnetic needle at various places in China during October and November 1883.] (By **W. Doberck.**) sm. f°. Sheet.

|| **Ferrari, C.**—Sulla dinamica dei temporali. Letta nella seduta del 15 giugno 1884. 3 pp. la. 4°. (*R. Accad. Lincei*, viii., *serie* 3ª, *Transunti.*)

|| **Giese, W.**—Ueber die in einer geschlossenen Kreisleitung auf der deutschen Polarstation zu Kingawa beobachteten Erdströme und eine sich daran knüpfende Methode zur Bestimmung des Ohm. 5 pp. la. 8°. Berlin, s.a. (*Elektrotechn. Zeitschr.*, 1885, *Feb.*)

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* **Liznar, J.**—Anleitung zur Messung und Berechnung der Elemente des Erdmagnetismus. 79 pp. la. 8°. Wien, 1883

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|| **Nipher, F. E.**—Magnetic survey of Missouri. Fifth Annual Report. 19 pp. 8°. (*Trans. St. Louis Acad. Sc.*, iv., *No.* 3, *p.* 516.)

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|| **(Ragona, D.)**—Studi sulla oscillazione diurna della declinazione magnetica. 17 pp. sm. f°. (*Mem. R. Accad. Sc., Modena, vol.* ii., *serie* ii., *p.* 305.)

Rajna, M.—Sulle variazioni diurne del magnetismo terrestre risultati di osservazioni fatte a Milano negli anni 1872 e 1877. Pubbl. R. Osserv. di Brera in Milano, N. xxvi. 60 pp., 8 plates, sm. f°. Milano, 1884.

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I—GEODESY.

‖ **Guisan, R.**—Notice sur le nivellement de précision de la Suisse. 48 pp., 1 plate, la. 8°. Paris, 1884. (*Mém. Soc. ingén. civils*, *4ème. série*, *8ème. vol.*, 1883.)

Lorenzoni, G., Celoria, G., e Nobile, A.—Operazioni eseguite nell' anno 1875 negli Osservatorii astronomici di Milano, Napoli e Padova in corrispondenza coll' Ufficio idrografico della R. Marina per determinare le differenze di longitudine fra Genova, Milano, Napoli e Padova. Pubbl. R. Osserv. di Brera in Milano, N. xxiv. 128 pp., sm. f°. Milano, 1883.

Surveyor General of India.—General report on the operations of the Survey of India Department, administered under the Government of India, during 1882–83. Prepared under the direction of Colonel **G. C. De Prée.** 75 + 96 + 21 + 5 pp., 40 plates, sm. f°. Calcutta, 1884.

K—HYDRAULICS, HYDROLOGY, AND TIDES.

Admiralty, London.—Tide tables for the British and Irish Ports, for the year 1885; also the times and heights of high water at full and change for the principal places on the Globe. Computed by **H. R. Harris.** vi. + 234 pp. la. 8°. London, (1884).

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Service hydrométrique du Bassin de la Seine.—Manuel hydrologique du bassin de la Seine, par **A. De Préaudeau,** sous la direction de **Ch. L. De Fourcy,** et **G. Lemoine.** ii. + 120 pp., 9 plates, 4°. Paris, 1884.

———.—Observations sur les Cours d'Eau et la Pluie centralisées pendant l'année 1882, sous la direction de **Ch. L. De Fourcy** par **G. Lemoine** et **A. Goupil.** 7 plates, f°. Versailles, s.a.

‖ ———.—Résumé des observations centralisées . . . . pendant l'année 1882 par **[A.] Goupil,** sous la direction de **[Ch.] L. De Fourcy** et de **G. Lemoine.** 43 pp. la. 8°. Versailles, 1884. (*Ann. Soc. météor. France*, xxxi., 1883, *Oct.*)

‖ **(Surveyor General's Office, Colombo.)**—Report on tidal waves in Ceylon resulting from the eruptions in the Straits of Sunda in August, 1883. By the Hon. **J. Stoddart.** 8 pp. f°. Colombo, 1884. (*Sessional Papers*, 1884, *p.* 21.)

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* **B.**—The science of the weather, in a series of letters and essays, by several authors; showing the fallacies and deficiencies of meteorological science, past and present, and the practicability of establishing a sound and useful philosophy of the nature and periods of weather changes. Edited by "B." 382 pp., 16 plates, sm. 8°. Glasgow, 1867.

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|| **Bebber, J. van.**—Die Untersuchungen von Hoffmeyer und Teisserenc de Bort über Wintertypen und der Winter 1883–84. 2 papers, 2 plates, sm. f°. (*Meteor. Zeitschr. deutsche meteor. Gesellsch., I. Jahrg.*, 1884, *p.* 22 *und* 70.)

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Freeden, W. v.—Barometerbuch zum Gebrauch der Seeleute. Nach der neuesten Ausgabe des "Barometer Manual for the use of Seamen" des "Meteorological Office" zu London aus dem Englischen übersetzt von W. v. Freeden. 43 pp. 2 plates, la. 8°. Oldenberg, 1885.

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* **Nourse, J. E.**—American explorations in the ice-zones. The expeditions of De Haven, Kane, Rodgers, Hayes, Hall, Schwatka, and De Long; the relief voyages for the Jeannette by the U.S. steamers Corwin, Rodgers, and Alliance; the cruises of Captains Long and Raynor of the Merchant Service: with a brief notice of the Antarctic cruise under Lieut. Wilkes, 1840, and of the locations and objects of the U. S. Signal Service Arctic Observers. 578 pp., 1 map, 2 plates, 6 portraits, 4°. Boston, s.a.

Office of the Chief Signal Officer, Washington.—Report on Lady Franklin Bay Expedition of 1883. Prepared under the direction of **W. B. Hazen** by **E. A. Garlington.** Signal Service Notes, No. x. 52 pp., 1 map, la. 8°. Washington, 1883.

———.—The elements of the heliograph. Prepared under the direction of **W. B. Hazen** by **F. K. Ward.** Signal Service Notes, No. xi. 12 pp. la. 8°. Washington, 1883.

———.—Work of the Signal Service in the Arctic regions. Prepared under the direction of **W. B. Hazen.** Signal Service Notes, No. v. 40 pp., 1 chart, la. 8°. Washington, 1883.

(Schück, A.)—Die Entwickelung unseres Bekanntwerdens mit den astronomischen, geographischen und nautischen Kenntnissen der Karolineninsulaner, nebst Erklärung der Medo's oder Segelkarten der Marshallinsulaner, im westlichen grossen Nord-Ocean. 26 pp., 2 plates, 8°. (*Tijdschr. nederl. Aardr. Genootsch. Amsterdam. Tweede serie, Deel* i., *p.* 226.)

‖ **Spottiswoode, W.**—Address of W. Spottiswoode, the President, delivered at the anniversary meeting of the Royal Society, on Thursday, November 30, 1882. 30 pp. 8°. London, 1882. [*Proc. R. Soc.*, xxxiv., 1882–83, *p.* 302.]

* **Supan, A.**—Grundzüge der physischen Erdkunde. xii. + 492 pp., 20 plates, la. 8°. Leipzig, 1884.

* **"The Times" register of events** in 1884. clxxiv. + 215 pp. 8°. London, 1885.

Tôkiô University.—Measurement of the force of gravity at Naha (Okinawa) and Kagoshima. By **S. Sakai** and **E. Yamaguchi.** Appendix to the Memoir No. 5 of Tôkiô Daigaku (Tôkiô University). 22 pp. la. 8°. Tôkiô, 2544 (1884).

APPENDIX XVIII.

METEOROLOGICAL OFFICE: ACCOUNT of RECEIPTS and PAYMENTS for the year ending 31st March 1885.

RECEIPTS.	£	s.	d.	£	s.	d.
Balance from year 1883–84				1,447	17	7
Parliamentary Vote				15,800	0	0
Repayment of expenses charged under—						
(1.) Incidental expenses	23	10	8			
(2.) Special researches	39	13	1			
				63	3	9
SUPPLY OF INFORMATION:—						
D.W. Charts and Forecasts	249	15	5			
6 p.m. Charts	25	0	0			
Information for Press Agencies, &c.	83	7	10			
Telegrams	151	3	2			
Miscellaneous data	11	17	7			
				527	4	0
SALE OF INSTRUMENTS, &c.:						
Royal Navy (A)	39	1	6			
Mercantile Marine account (B)	73	7	4			
				112	8	10
Commissions executed for Colonial and Foreign Institutions, &c. (C)				272	3	7
Commission charged on work done for Colonies, &c.				26	6	4
				£17,749	4	1

PAYMENTS.	£	s.	d.	£	s.	d.
ADMINISTRATION:						
Payment of Council	1,000	0	0			
Secretary	800	0	0			
Salaries and wages	758	16	0			
Rent, fuel, and lighting	712	13	8			
Incidental and contingent expenses:—						
Attendance, cleaning, &c.	440	16	3			
Furniture and fittings	39	18	1			
Pensions	42	16	4			
				3,795	0	4
SPECIAL RESEARCHES				1,050	7	9
LAND METEOROLOGY:						
Observatories and stations	1,822	16	11			
Discussion and reduction of observations	1,299	13	5			
				3,122	10	4
WEATHER INFORMATION AND FORECASTS:						
Telegraphic reports and storm warnings	3,135	10	8			
Preparation and issue of reports and forecasts	1,524	15	3			
				4,660	5	11
INSPECTIONS:						
Salaries and travelling expenses				560	12	1
OCEAN METEOROLOGY:						
Discussion and reduction of observations	1,804	1	0			
Expenses incidental to the supply of instruments:—						
Proportion for care and issue of instruments	200	0	0			
Royal Navy	174	5	5			
Mercantile Marine	355	13	3			
Distant island and coast stations	20	9	0			
				2,554	8	8
Commissions executed for Colonial and Foreign Institutions, &c.				262	14	2
				16,005	19	3
BALANCE:						
Cash at Bank	1,613	4	9			
„ at Office	80	0	1			
Advance to Valencia Observatory	50	0	0			
				1,743	4	10
				£17,749	4	1

APPENDIX XIX.

LIST OF PUBLICATIONS, &c. issued under the Authority of the Meteorological Council.

OFFICIAL.

No. 1. Report for 1867. Presented to Parliament. 1*s.*

2. Instructions for Meteorological Telegraphy. New Edition. (1875.) 6*d.*

3. Fishery Barometer Manual. 6*d.*

4. Charts of Surface Temperature, South Atlantic Ocean. 2*s.* 6*d.*

5. Report for 1868. Presented to Parliament. 5*d.*

6. Report for 1869. Presented to Parliament. 10*d.*

7. Quarterly Weather Report for 1869.—Parts I. to IV. 5*s.* each.

8. The Barometer Manual (out of print, see Nos. 24, 40, 60, and 61).

9. Quarterly Weather Report for 1870.—Parts I. to IV. 5*s.* each.

10. Report for 1870. Presented to Parliament. 10*d.*

11. Contributions to our Knowledge of the Meteorology of Cape Horn and the West Coast of South America. 2*s.* 6*d.*

12. Currents and Surface Temperature of the North Atlantic Ocean, from the Equator to Lat. 40° N., for each month of the year, with a General Current Chart. 2*s.* 6*d.*

13. A Discussion of the Meteorology of the Part of the Atlantic lying North of 30° N., for the Eleven Days ending 8th February 1870. Price, with Book of Charts, 5*s.*

14. Quarterly Weather Report for 1871.—Parts I. to IV. 5*s.* each.

15. Report for 1871. Presented to Parliament. 10*d.*

16. Quarterly Weather Report for 1872.—Parts I. to IV. 5*s.* each.

17. Report for 1872. Presented to Parliament. 1*s.*

18. Contributions to our Knowledge of the Meteorology of the Antarctic Regions. 2*s.*

19. Quarterly Weather Report, 1873.—Parts I. to IV. 5*s.* each.

20. Charts of Meteorological Data for Square 3. Lat. 0°—10° N. Long. 20° — 30° W., and Remarks to accompany the Monthly Charts, which show the Best Routes across the Equator for each Month, &c. 20*s.*

21. Report of the Proceedings of the Meteorological Congress at Vienna. 1*s.*

22. Report for 1873. Presented to Parliament. 4*d.*

LIST OF PUBLICATIONS, &c.—*continued.*

No. 23. Report of the Proceedings of the Conference on Maritime Meteorology held in London, 1874. 2*s.*

24. Instructions in the Use of Meteorological Instruments. [Reprinted 1885. 6*s.*]

25. Quarterly Weather Report for 1874.—Parts I., II., and IV. 5*s.* each. Part III., 5*s.* 9*d.*

26. Report for 1874. Presented to Parliament. 6*d.*

27. Charts of Meteorological Data for the Nine 10° Squares of the Atlantic which lie between 20° N. and 10° S., and extend from 10° to 40° W., with accompanying Remarks, ending with the Best Routes across the Equator. 24*s.*

28. Contributions to our Knowledge of the Meteorology of Japan. By Staff-Commander Thomas H. Tizard, H.M.S. *Challenger.* 1*s.*

29. Report for 1875. Presented to Parliament. 4*d.*

30. Quarterly Weather Report for 1875.—Parts I.—IV. 5*s.* each.

31. Report for 1876–7. Presented to Parliament. 3*s.* 5*d.*

32. A Discussion of the Meteorology of the North Atlantic during August 1873, with 31 Synoptic Charts. 15*s.*

33. Quarterly Weather Report for 1876. (New Series.) Part I., 6*s.*; Parts II.—IV., 5*s.* each.

34. Contributions to our Knowledge of the Meteorology of the Arctic Regions.—Part I., 2*s.*; Part II., 10*s.*; Part III. 6*s.* Part IV. (In the press.)

35. Report for 1877–8. Presented to Parliament. 1*s.*

36. Report of the Proceedings of the Meteorological Congress at Rome, 1879. 1*s.* 6*d.*

37. Report on the Meteorology of Kerguelen Island. By the Rev. S. J. Perry, S.J., F.R.S. 3*s.*

38. Report for 1878–9. Presented to Parliament. 5*d.*

39. Meteorological Observations at Stations of the Second Order for the year 1878. 20*s.*

40. Aids to the Study and Forecast of Weather, by the Rev. W. Clement Ley, M.A. 1*s.*

41. Report for 1879–80. Presented to Parliament. 1*s.*

42. Report for 1880–81. Presented to Parliament. 1*s.* 2*d.*

43. Charts of Meteorological Data for the Ocean District adjacent to the Cape of Good Hope, with accompanying Remarks. Price of the Charts, 25*s.*; of the Remarks, 7*s.*

44. Report on the Gales experienced in the Ocean District adjacent to the Cape of Good Hope, between Lat. 30° and 50° S., and Long. 10° and 40° E., by Capt. H. Toynbee, F.R.A.S. 7*s.* 6*d.*

45. Meteorological Observations at Stations of the Second Order for the year 1879. 20*s.*

LIST OF PUBLICATIONS, &c.—*continued.*

No. 46. Report on the Storm of October 13–14, 1881. By Robert H. Scott, F.R.S. 1*s.* 6*d.*

47. Rainfall Tables of the British Isles for 1866–80. Compiled by G. J. Symons, F.R.S. 7*s.* 6*d.*

48. Report for 1881–2. Presented to Parliament. 1*s.*

49. Quarterly Weather Report for 1879. (New Series.) Appendices and Plates. 27*s.*

50. Quarterly Weather Report for 1880. (New Series). Appendices and Plates. 28*s.*

51. Hourly Readings, 1881. (New Series.) Part I., 10*s.* 6*d.* Parts II., III., and IV., 21*s.* each.

52. Quarterly Weather Report for 1877. (New Series.) Appendices and Plates. 27*s.* Part I., 10*s.* Part II., 5*s.* Part III. 4*s.* 6*d.* Part IV. (In the Press.)

53. Meteorological Atlas of the British Isles. 5*s.* 6*d.*

54. Hourly Readings, 1882. (New Series.) Parts I. and II. 20*s.* each. Part III., 22*s.* 6*d.* Part IV. 26*s.*

55. Quarterly Weather Report for 1878. (New Series.) Appendices and Plates. 28*s.*

56. Sunshine Records of the United Kingdom for 1881. 4*s.*

57. Meteorological Observations at Stations of the Second Order for the year 1880. 34*s.* 6*d.*

58. Report for 1882–3. Presented to Parliament. 10½*d.*

59. Sea Temperature Charts for the Atlantic, Indian, and Pacific Oceans. 21*s.*

60. Principles of Weather Forecasting. By the Hon. Ralph Abercromby, F.R. Met. Soc. 1*s.* 9*d.*

61. The Barometer Manual for the Use of Seamen. 1*s.* 3*d.*

62. Monthly Weather Reports for 1884:—Jan.–March, May–Nov. 1*s.* 6*d.* each. April (with two Appendices). 2*s.* 6*d.* Dec. 1*s.* 9*d.*

63. Hourly Readings, 1883. (New Series.) Parts I. and II. 21*s.* each. Part III. (In the Press.)

64. Report for 1883–4. Presented to Parliament. 1*s.* 2*d.*

65. Monthly Weather Report for 1885. January–May. 1*s.* 6*d.* each. June–August. (In the Press.)

NON-OFFICIAL.

No. 1. Report to the Committee on the Connexion between Strong Winds and Barometrical Differences.—By Robert H. Scott, Director of the Office. 6*d.*

2. Report to the Committee on the Meteorology of the North Atlantic.—By Captain H. Toynbee, Marine Superintendent. 1*s.*

3. Report to the Committee on the Use of Isobaric Curves.—By Captain H. Toynbee, Marine Superintendent. 1*s.*

LIST OF PUBLICATIONS, &c.—*continued.*

NON-OFFICIAL—*continued.*

No. 4. Routes for Steamers from Aden to the Straits of Sunda and back. Translated from a Paper issued by the Royal Meteorological Institute of the Netherlands. *6d.*

5. On the Winds, &c. of the North Atlantic along the Tracks of Steamers from the Channel to New York. Translated from a Paper issued by the Deutsche Seewarte, Hamburg. *6d.*

6. Report of the Proceedings of the Meteorological Conference at Leipzig. *1s.*

7. Notes on the Form of Cyclones in the Southern Indian Ocean.—By C. Meldrum, Esq., M.A., F.R.S. *6d.*

8. Report on Weather Telegraphy and Storm Warnings. Presented to the Meteorological Congress at Vienna. *6d.*

9. Report of the Permanent Committee of the Vienna Congress for 1874. *1s. 6d.*

10. On the Physical Geography of the part of the Atlantic which lies between 20° N. and 10° S., and extends from 10° to 40° W. A Paper read before the British Association at Bristol, in August 1875, by Capt. Toynbee, F.R.A.S., F.R.G.S., Marine Superintendent. *1s. 6d.*

11. Report of the Permanent Committee of the Vienna Congress for 1876. *2s.*

12. Reports to the Permanent Committee of the Vienna Congress on Atmospheric Electricity, Maritime Meteorology, and Weather Telegraphy, 1878. *2s.*

13. Report of the Permanent Committee of the Vienna Congress for 1878. *6d.*

14. Report of the International Meteorological Committee Meeting at Berne, 1880. *1s.*

15. Report of the Second Meeting of the International Meteorological Committee, held at Copenhagen, August 1882. *2s. 6d.*

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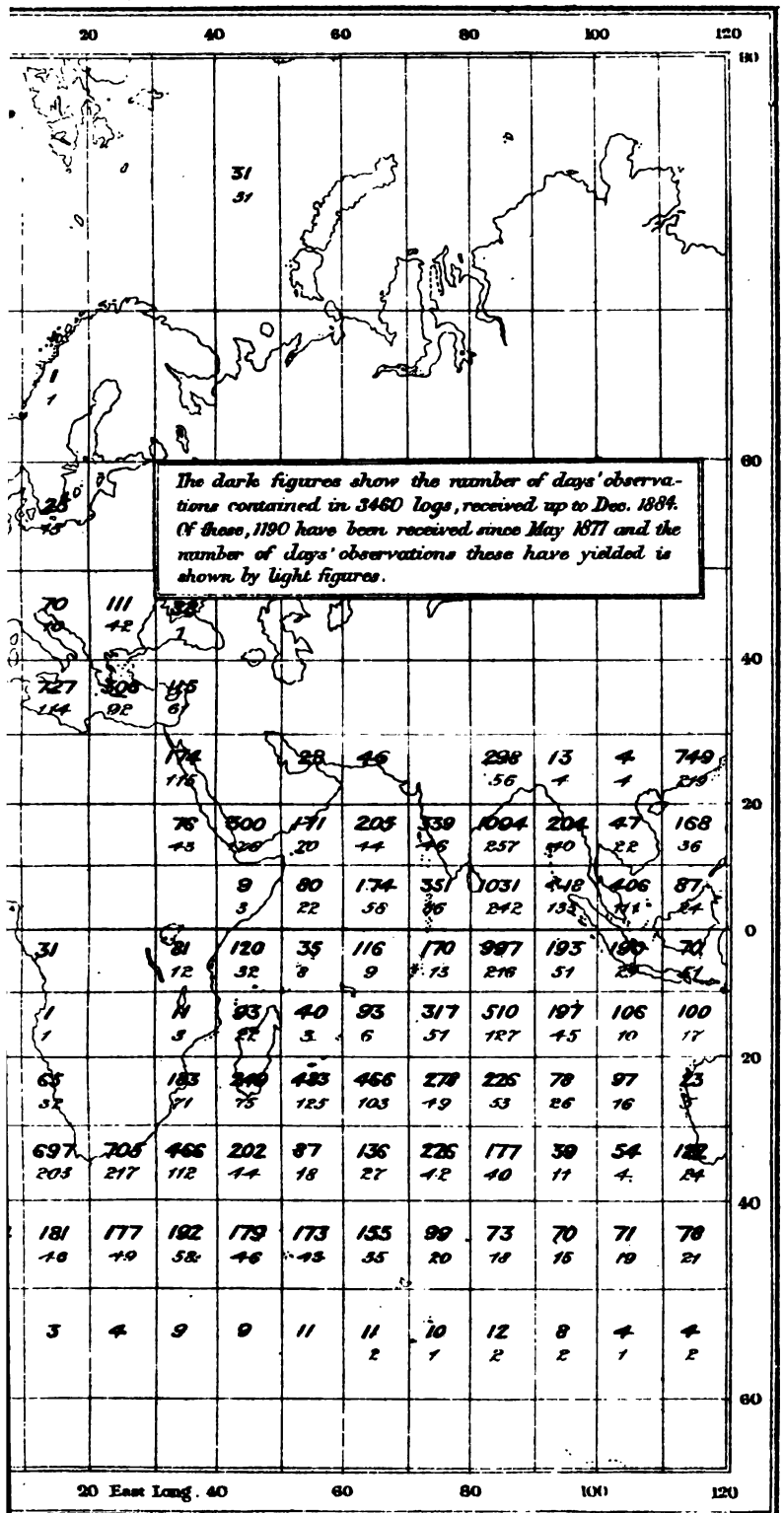
JANUARY.



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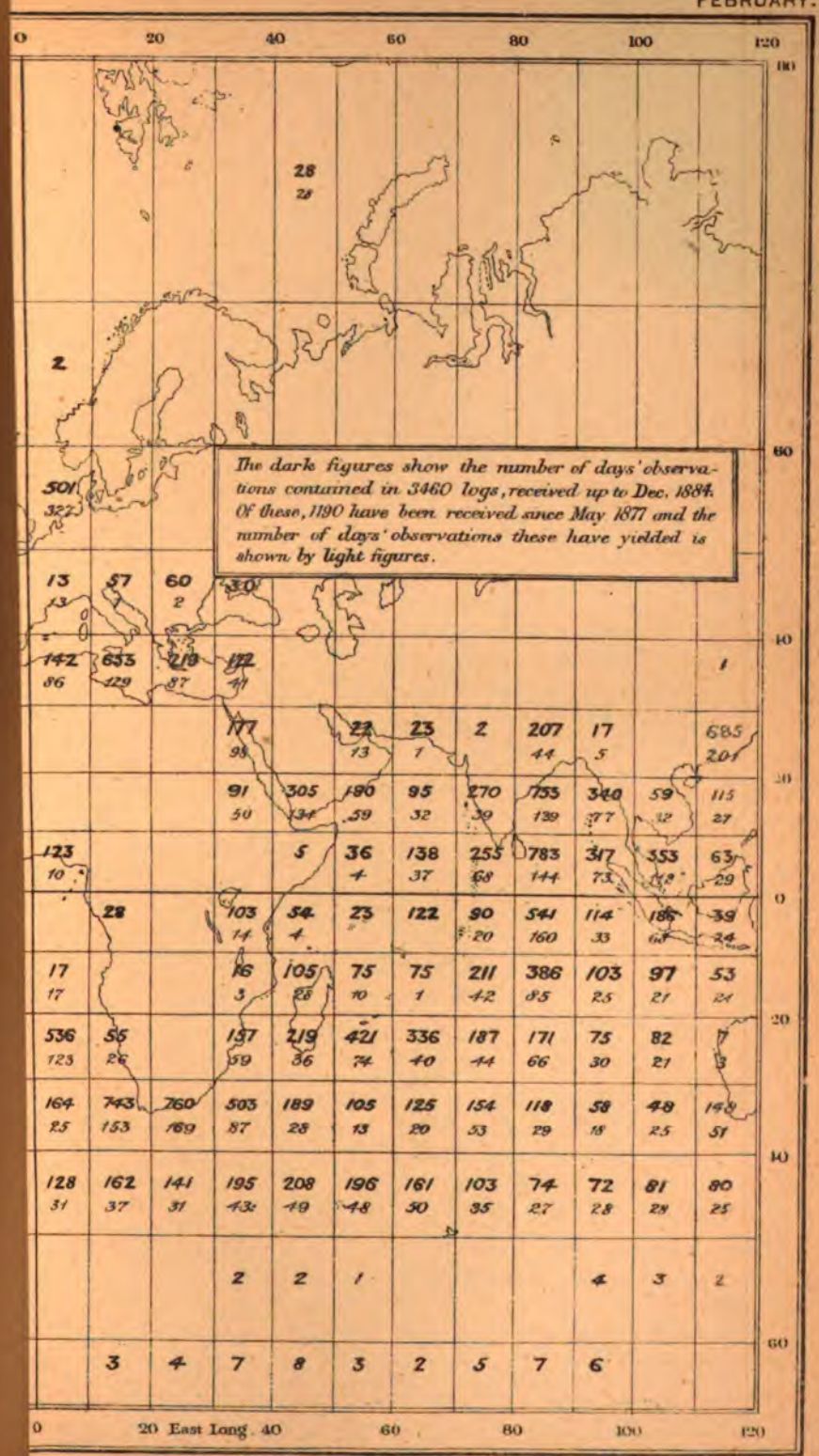

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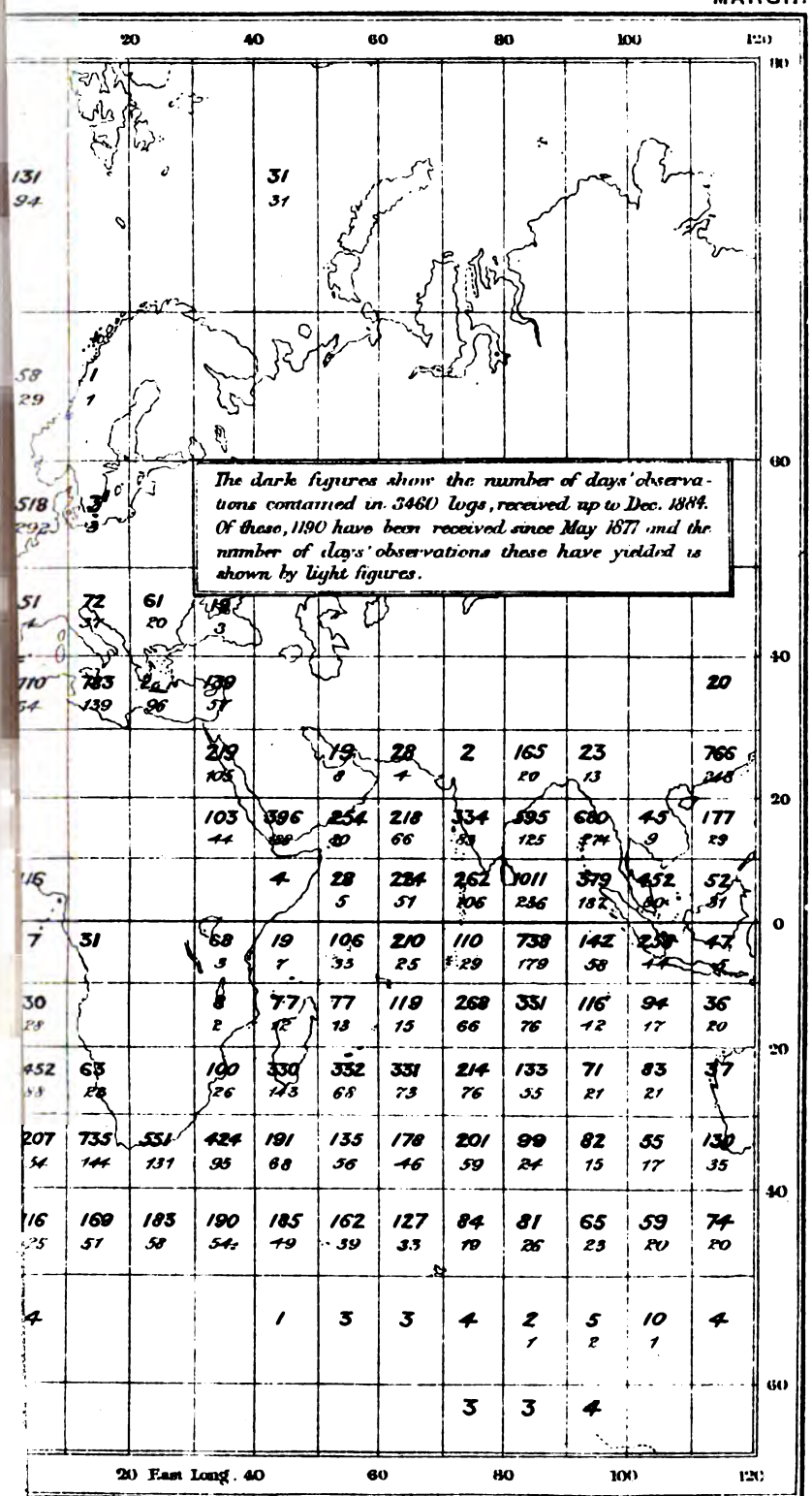
MARCH.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The dark figures show the number of days' observations contained in 3460 logs, received up to Dec. 1884. Of these, 1190 have been received since May 1877 and the number of days' observations these have yielded is shown by light figures.
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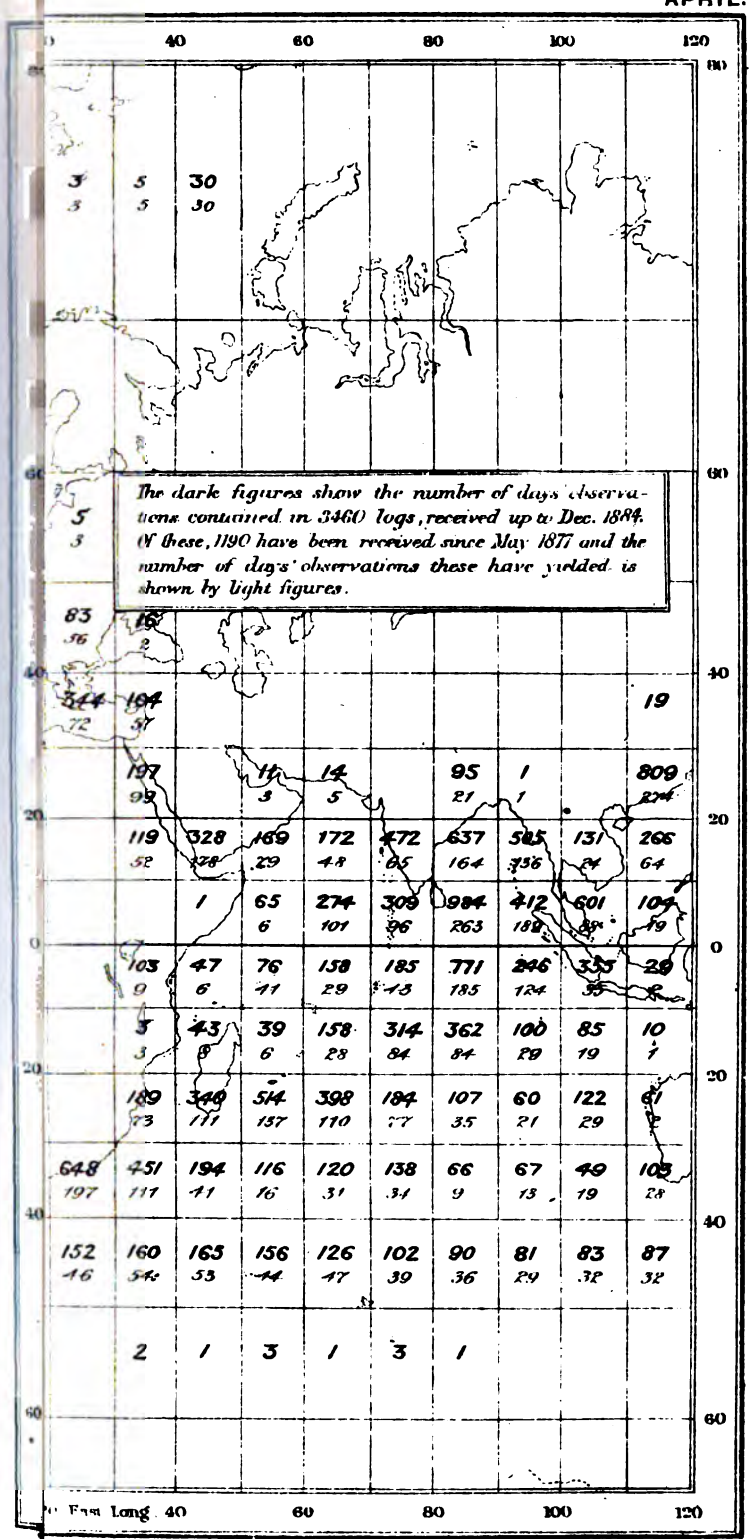
APRIL.



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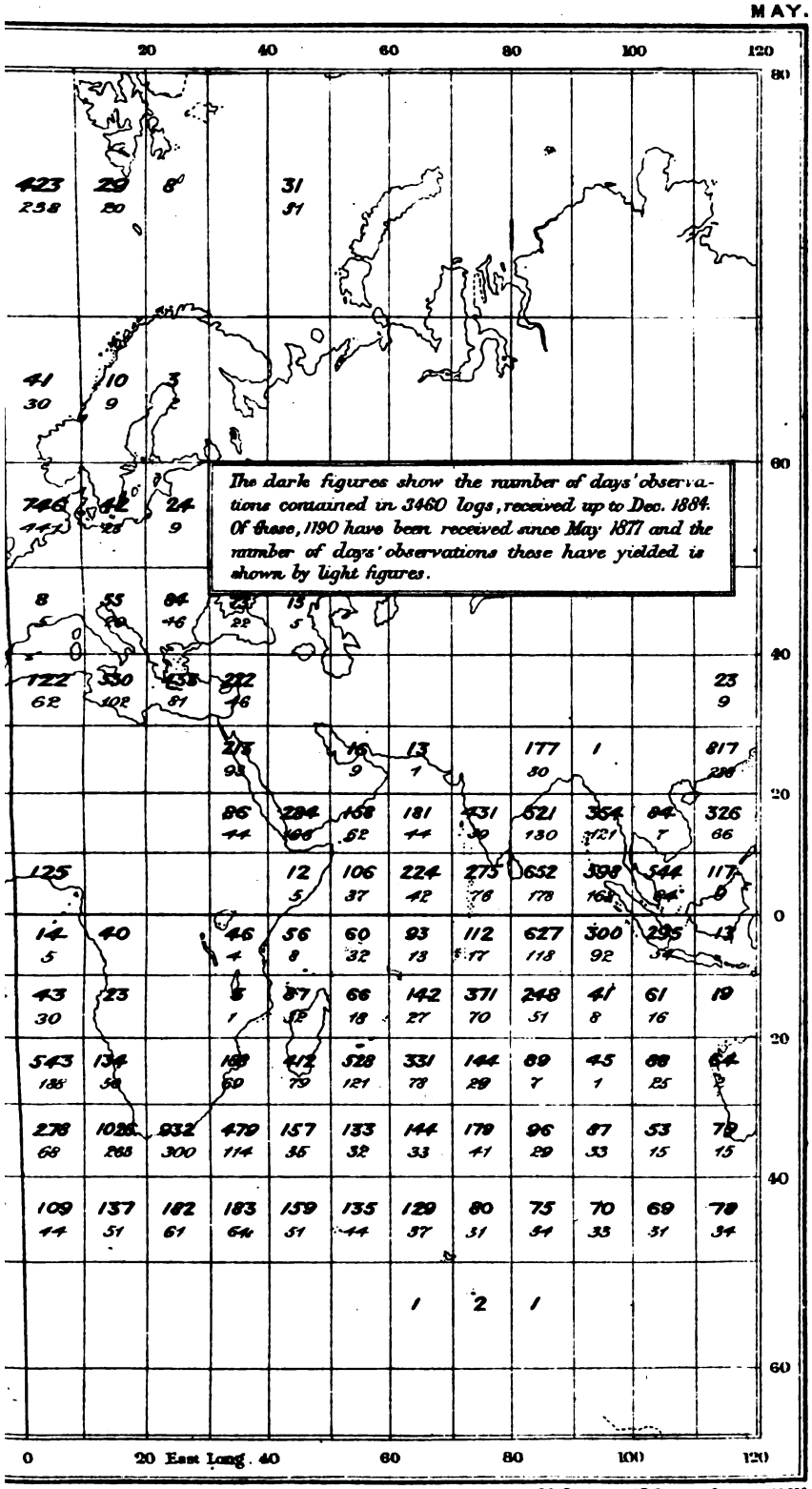

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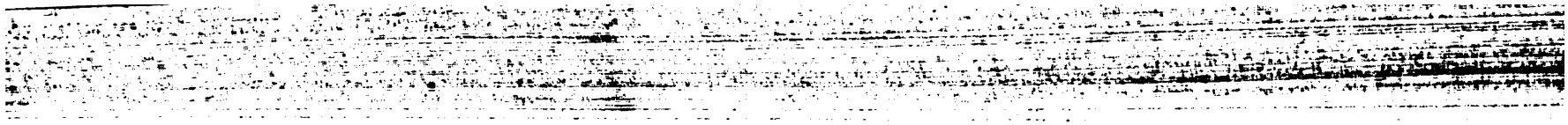

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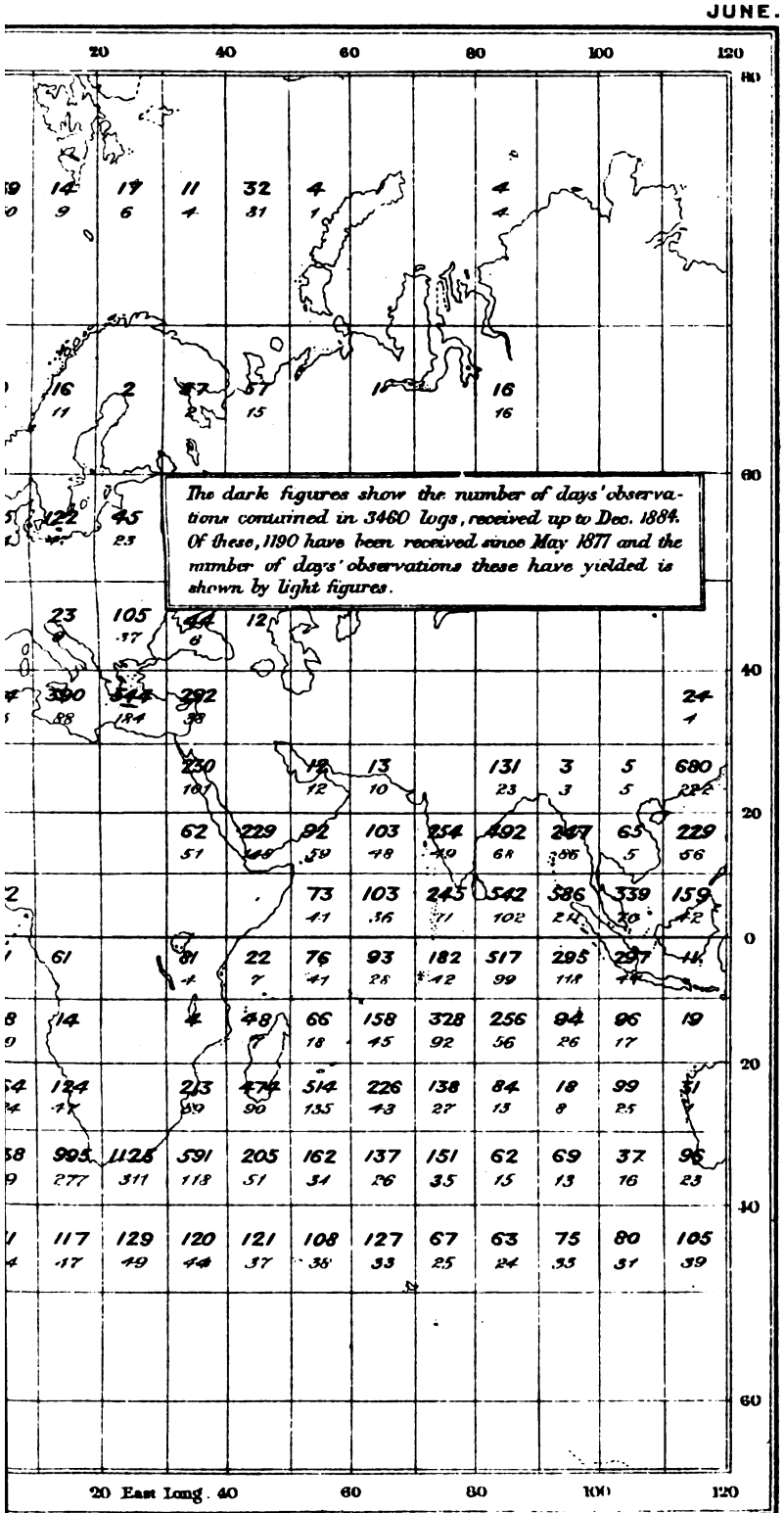

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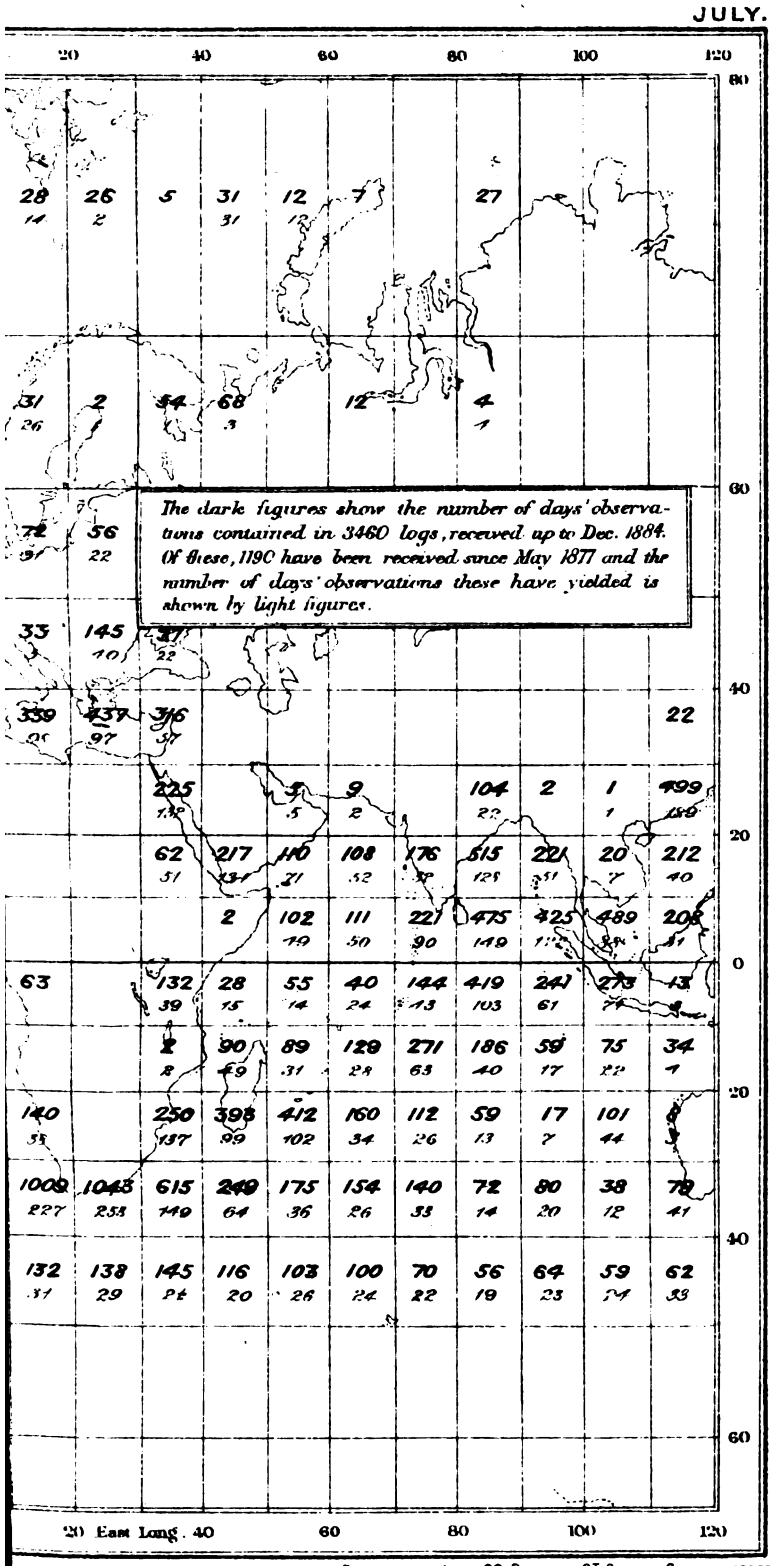

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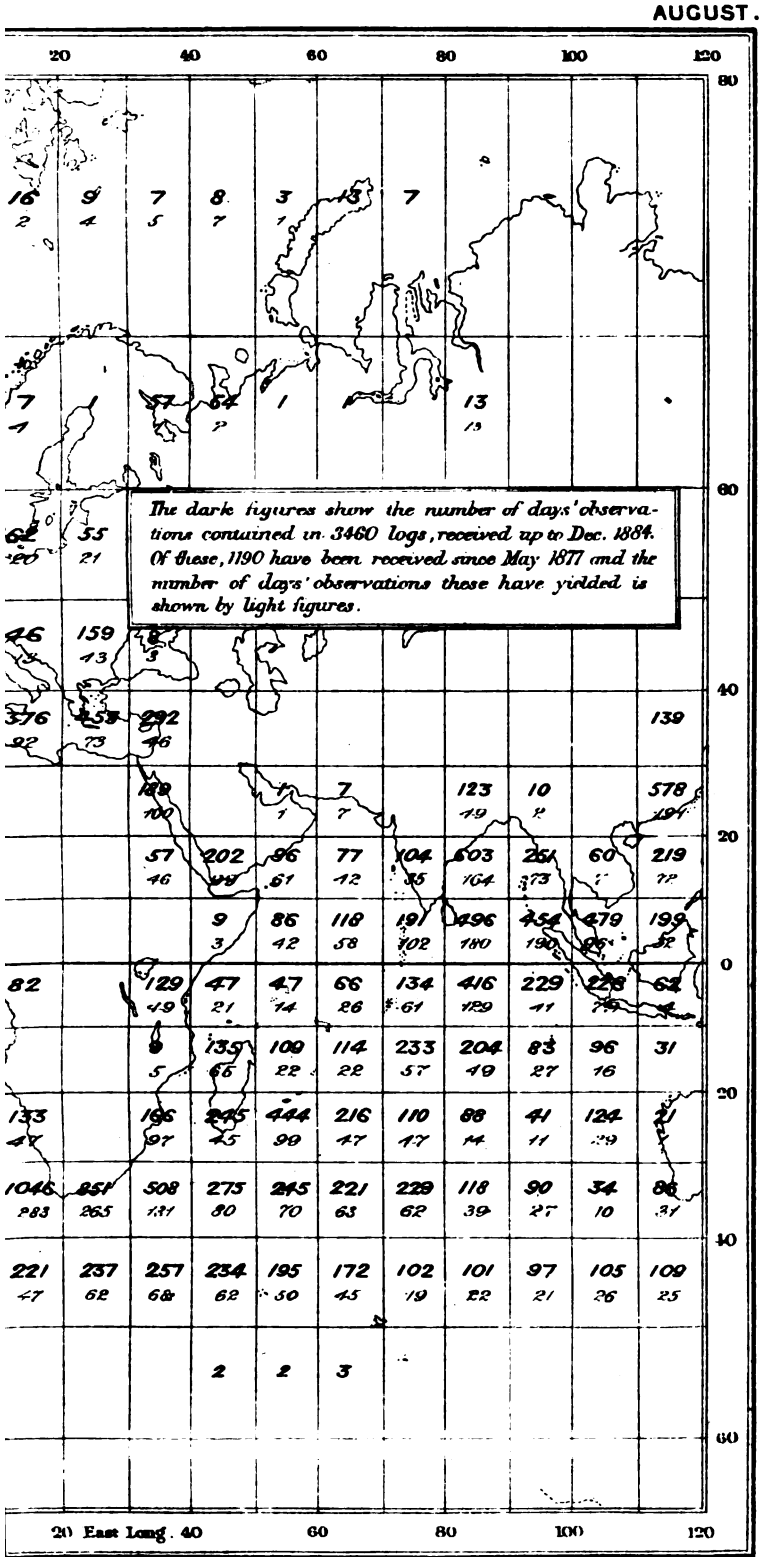

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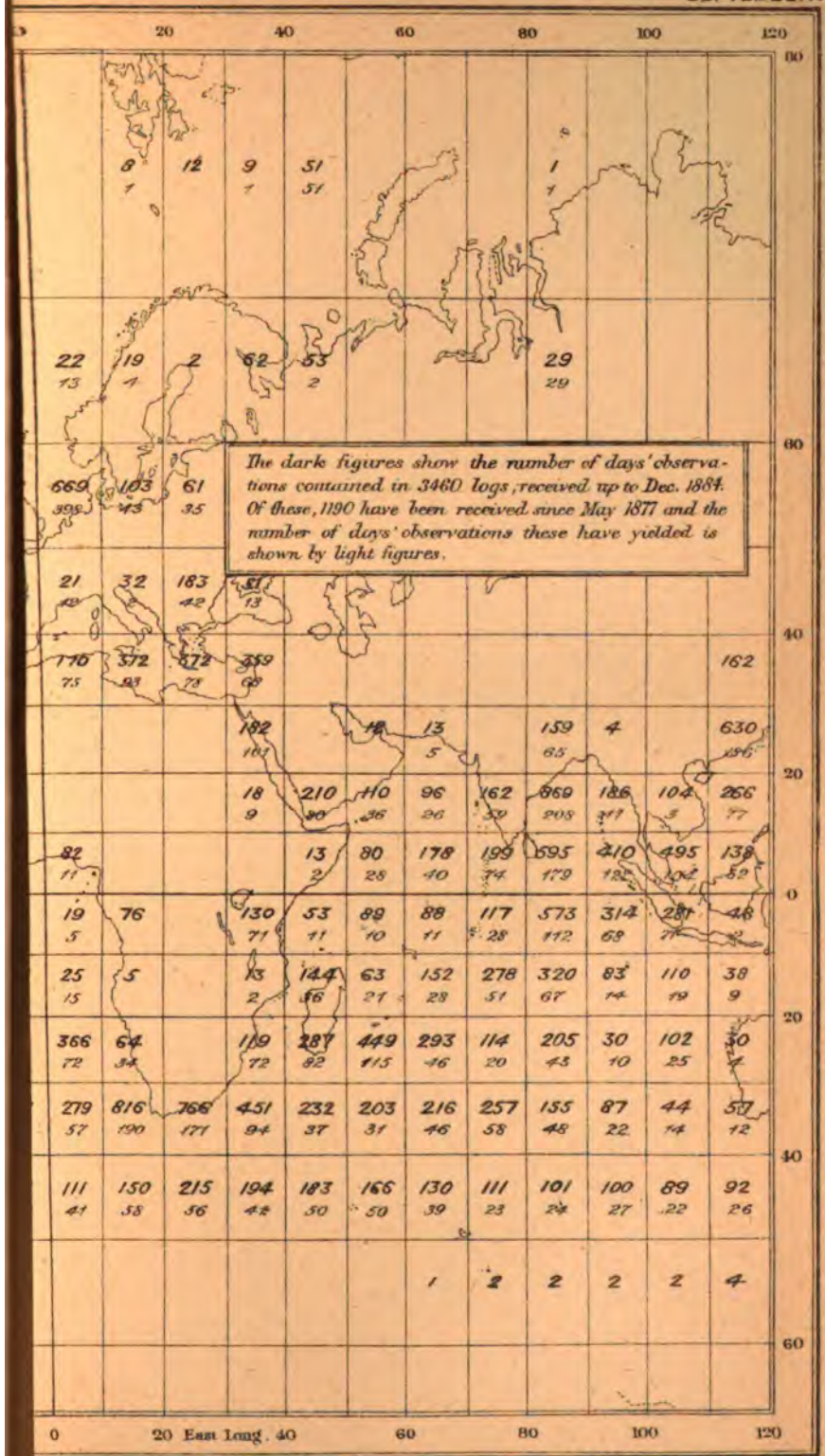
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The dark figures show the number of days' observations contained in 3460 logs, received up to Dec. 1884. Of these, 1190 have been received since May 1877 and the number of days' observations these have yielded is shown by light figures.

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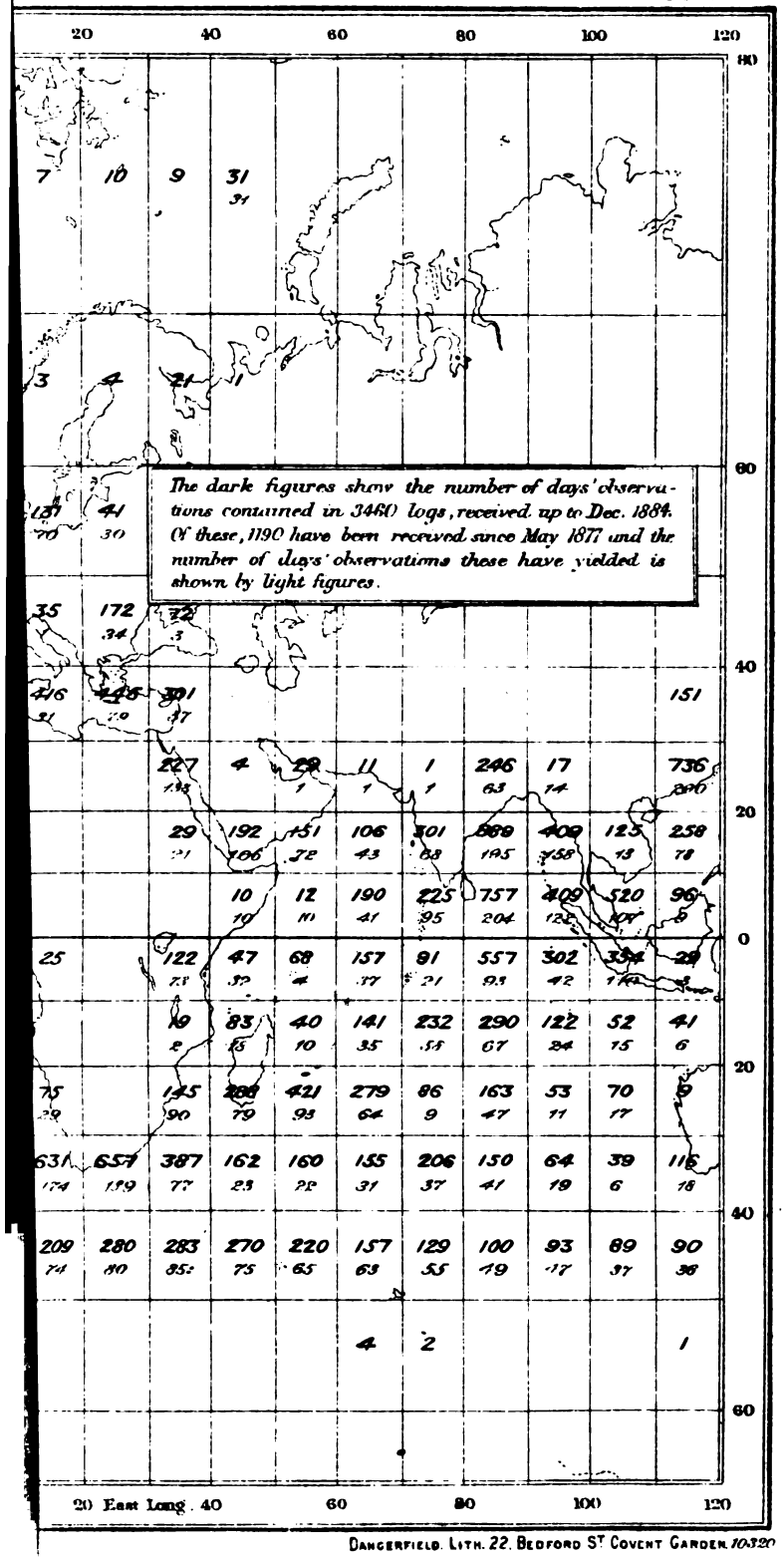
OCTOBER.



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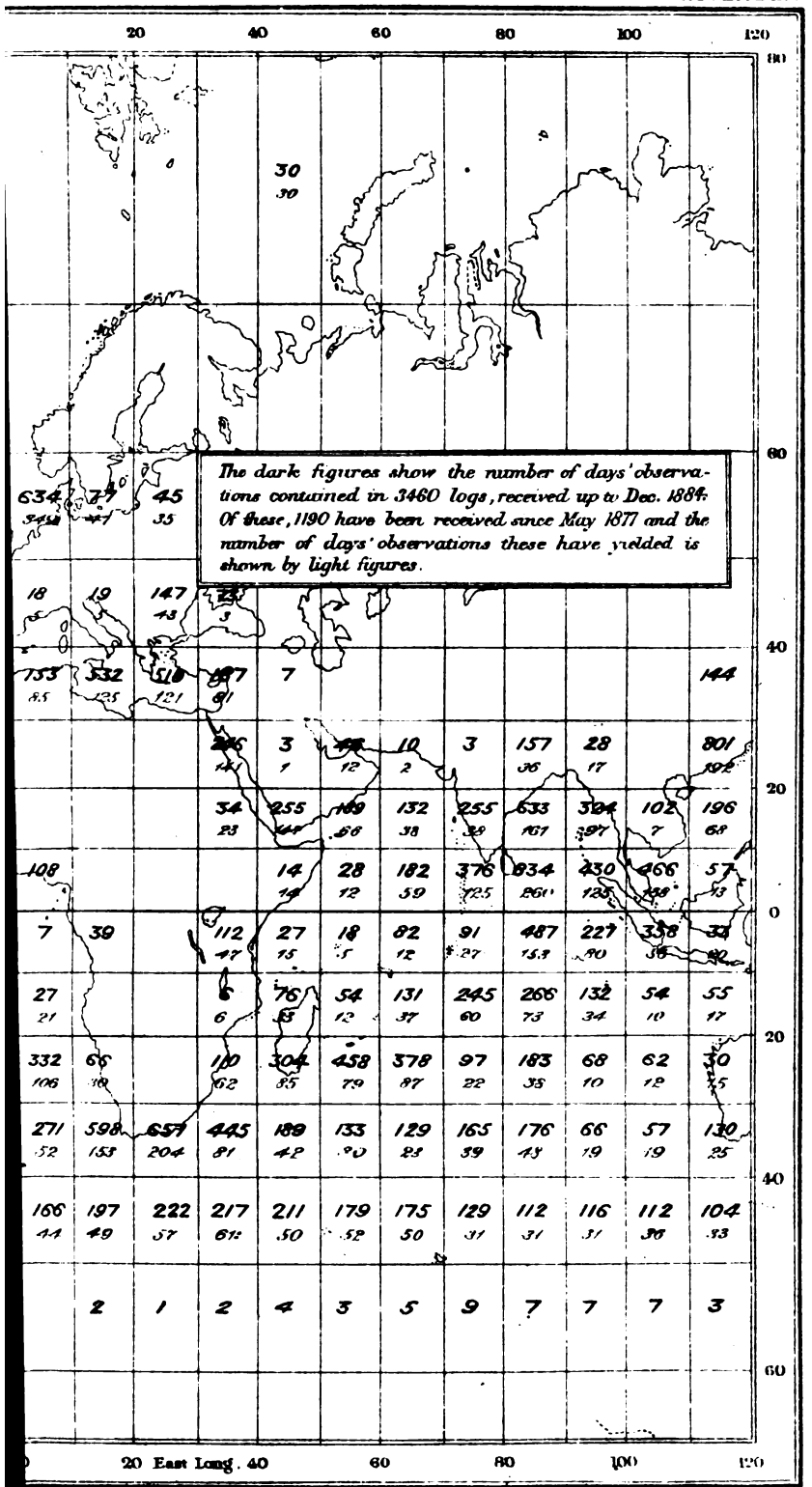

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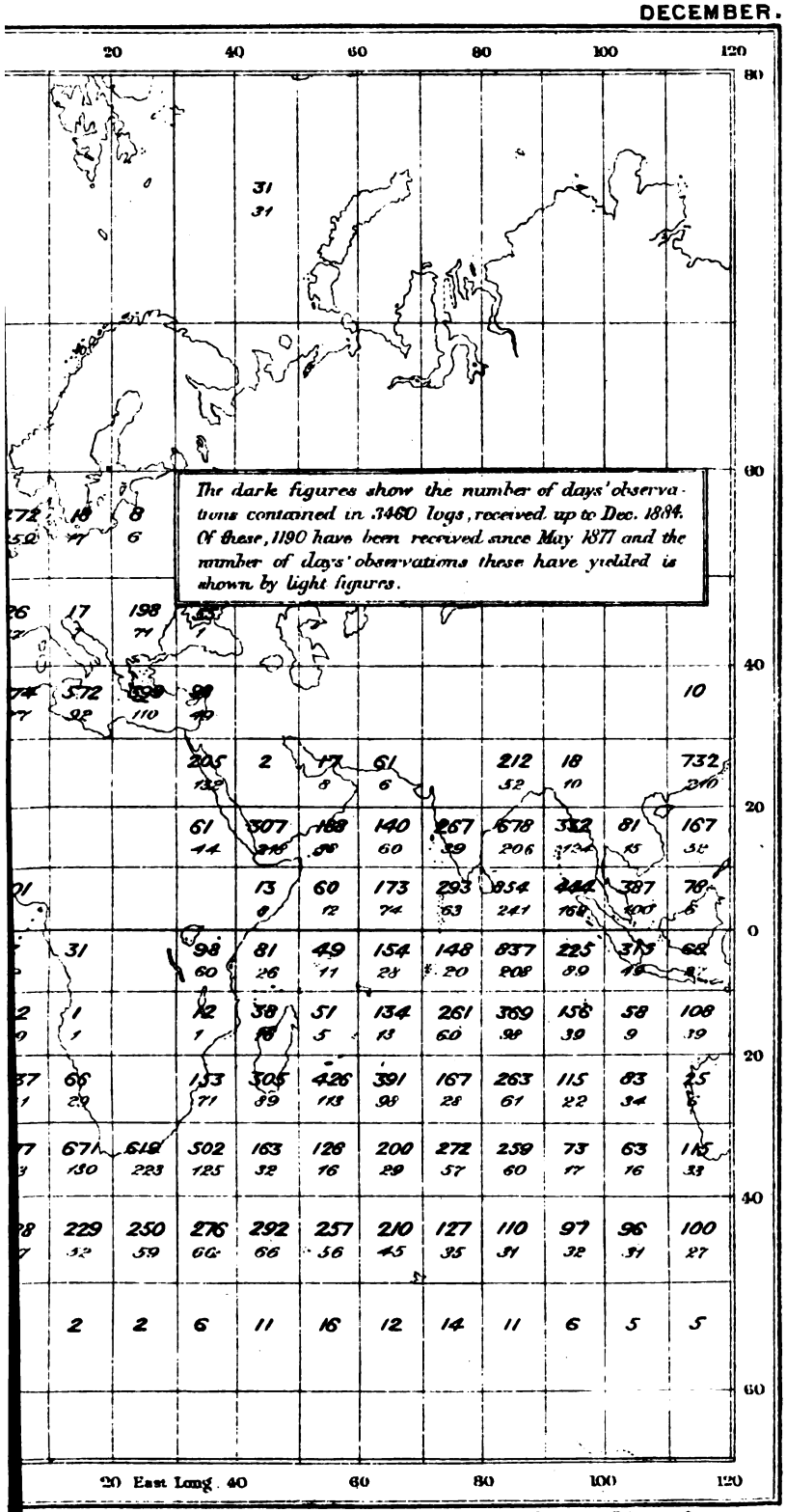
DECEMBER.



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REPORT

OF THE

METEOROLOGICAL COU

TO THE

ROYAL SOCIETY,

For the Year ending 31st of March 1

Presented to both Houses of Parliament by Command of Her

LONDON:
PRINTED BY EYRE AND SPOTTISWOO
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.
FOR HER MAJESTY'S STATIONERY OFFICE.

1880.

REPORT

OF THE

METEOROLOGICAL COUNCIL

TO THE

ROYAL SOCIETY,

For the Year ending 31st of March 1898.

Presented to both Houses of Parliament by Command of Her Majesty.

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1898.

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REPORT

OF THE

METEOROLOGICAL COUNCIL

TO THE

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For the Year ending 31st of March 1886.

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1887.

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THE METEOROLOGICAL COUNCIL,

1885–86.

Lieutenant-General Richard Strachey, C.S.I., F.R.S., Chairman.

Professor George Howard Darwin, M.A., LL.D., F.R.S.

Mr. Francis Galton, M.A., F.R.S.

Professor George Gabriel Stokes, LL.D., P.R.S.

Mr. Edward J. Stone, M.A., F.R.S.

Captain William J. L. Wharton, Hydrographer of the Admiralty.

REPORT

OF THE

METEOROLOGICAL COUNCIL

TO THE

ROYAL SOCIETY,

For the Year ending March 31, 1886.

Introductory.

No change has taken place in the Council during the year, and its executive officers continue as before:—

Mr. R. H. Scott, M.A., F.R.S., Secretary.
Captain H. Toynbee, F.R.A.S., Marine Superintendent.
Navigating-Lieutenant C. W. Baillie, F.R.A.S., Assistant do.

A scheme for the future organization of the clerical staff of the office has been adopted, with a view to regulating the scale of salaries and the rate of increments, and to avoiding the inconvenience found to arise from having to deal with individual claims for increases.

The classification adopted is as follows:—

6 clerks in	Class	I. from	225*l.* to 275*l.*
„	„	II. „	175*l.* to 200*l.*
6 „	„	III. „	125*l.* to 150*l.*
7 „	„	IV. „	75*l.* to 110*l.*

The chief clerkship is not considered as coming within these classes.

The salaries are for eight hours' work daily; the increments allowed are 5*l.* yearly, until the maximum is reached, and are only granted on a report that the clerk's conduct has been in all respects satisfactory.

The present Report is as usual arranged under three headings:—

I. Ocean Meteorology.
II. Weather Telegraphy.
III. Land Meteorology of the British Isles.

PART I.

Ocean Meteorology.

Collection of information.

Collection of Information.—The practice followed by the Office as regards its dealing with observers at sea has not been changed, and is described in former Reports.

Recognition of "excellent" observers.

Appendix I. (p. 25) contains a list of all the observers who have contributed "excellent" logs during the past year. Some

of them have regularly co-operated with the Office for many years; the names which now appear in the list for the first time are as follows:—

Captain's Name.	Ship.
Adamson, A. W.	S.S. "Brindisi."
Atkinson, S. P. H.	"Edmonton."
Brown, E.	"Moorhill."
Carr, H. C.	"Superb."
Clapp, Staff-Comr. E. S., R.N.	L.H. Tender "Richmond."
Cummings, William	S.S. "Dracona."
Davies, Joseph	S.S. "Archimedes" and S.S. "Flaxman."
Flinton, Benjamin	"Dartmouth."
Fraser, W. D.	"Thomas S. Stowe."
Freeman, G. A.	"Hannah and Mary."
Heyman, Sub-Lieut. G. A., R.N.	H.M.S. "Myrmidon."
Hird, William	"Marlborough."
Lambert, Sub.-Lieut. H. M., R.N.R.	S.S. "Brindisi."
Lewis, B. C.	"British Merchant."
Lowe, James	"Agnes Muir."
Lugar, W. R.	S.S. "Mackay-Bennett."
Lyne, Sub-Lieut. W. O., R.N.	H.M.S. "Flying Fish."
McLean, Archibald	S.S. "Titania."
McMillan, John	"Canterbury."
Maxwell, Joseph	"Oamaru."
Moignard, P.	"Allonby."
Plater, H. R. F.	"Patriarch."
Quaile, D. W. A.	"Orissa."
Sangster, William	S.S. "Dracona."
Sargent, A. H.	"Glenlora."
Scott, George	"Iolanthe."
Sheldrake, J. W.	"Iron Cross."
Sturdee, H. King	L.H. Tender "Richmond."
Tindall, W. A.	S.S. "International."
Wilson, John	S.S. "Ethiopia."

The Council regret to have to record the death of Staff-Commr. W. M. Savage, R.N., and of Mr. Thomas Goodwin Partington,* who were "excellent" observers.

Proportion of "excellent" to total number of logs received.

The following is the total number of logs received from April 1, 1885, to March 31, 1886, and the number of logs which have been classed as "excellent":—

Total No. of Logs received.	No. of Excellent Logs.	Per-centage of Excellent Logs.
189	138	73

The average number of logs received annually during the five years, 1880–84, was 164, and the per-centage of excellent logs among these was 72.

The Council take this opportunity of expressing their best thanks to the observers who have assisted them during the past year.

* Mr. Partington obtained the prize for Meteorology, given by the Council for the best answers in meteorology, on board the "Conway" in 1881. He had helped to keep three "excellent" logs for the Office. He was lost overboard in a gale of wind, December 22, 1885.

On the 31st of March 1886 the ships observing for the Office were pursuing the following voyages:— Districts from which observations are obtained.

To Baffin's Bay or Greenland	6
„ North America, East Coast	12
„ „ „ West „	9
Off East Coast of North America	4
To South America, East Coast	10
„ „ „ West „	3
„ Australia and New Zealand, viâ Cape of Good Hope	31
„ „ „ „ Suez	2
„ India, viâ Suez	6
„ India, viâ Cape of Good Hope	26
„ China Seas, viâ Cape of Good Hope	3
„ „ „ Suez	4
„ West Coast of Africa	1
„ Mediterranean Ports	6
„ Cape of Good Hope	6
„ West Indies	10
Between British Ports	4
Unknown	8
Total number of ships	151

Appendix II. (p. 28) supplies a list of the logs and of all the documents from stations abroad received at the Office during the year.

North Atlantic Weather Charts.—The investigation of the weather over the North Atlantic Ocean for the 13 months, beginning August 1st, 1882, and ending August 31st, 1883, the period during which the International System of Circumpolar Observations was carried out, has still continued to employ nearly the whole Marine Branch of the Office, and steady progress has been made with the work. Nearly 3,000 ships co-operated, and 11,236 forms have been received, yielding an average of 864 for each of the 13 months, and upwards of 400 observations for each day. These figures are exclusive of the returns from land stations, which number about 300, so that there are in all about 700 sets of observations for each day. As seven of the circum-polar stations fell within the limits of the area dealt with (30° E. to 120° W.), their observations have been incorporated, and have rendered the charts for the higher latitudes far more complete than they would otherwise have been. Synchronous weather charts.

The principal features of the method adopted for carrying out the investigation, with specimen charts, will be found at pp. 8–10 of the Report for 1883. It is intended to publish the whole series of these daily charts on a reduced scale in pairs, one chart representing the pressure and wind, the others the air and sea temperature, for each day, together with the record of weather (rain, &c.) which is reproduced on each chart, and the first part of this publication, containing 33 sheets, will probably appear during the summer. The charts of three consecutive days will be printed on each sheet.

Synchronous weather charts.

The labour and time occupied in preparing the charts, and in carrying out this investigation, have been very great, but the progress already made gives sure indications that the results obtained from it will be of great value and novelty, and of a nature that could not be obtained in any other way.

The following statement shows the stage at which the work had arrived by the end of March 1886:—

The charts for November were ready for the lithographer.

The whole of the observations for sea and land, had been entered on the large scale original charts, and all isobars and isotherms had been drawn.

The generalized wind arrows had been entered up to the end of April, and the weather areas drawn up to the end of February 1883. The reduced drawings from which the lithographed charts are reproduced by help of photography had been completed up to the end of November. The charts for three months, August to October 1882, were in the lithographer's hands.

Red Sea Charts.

Red Sea Charts.—It is proposed to take up the preparation of monthly charts of the meteorology, currents, surface temperature, and specific gravity of the Red Sea, according as the Atlantic work progresses towards completion. Specimen charts for one month have been drawn. The Indian Meteorological Department has undertaken to deal with the corresponding data for the Indian Ocean, and their charts are understood to be in progress.

The Royal Meteorological Institute of the Netherlands having applied for assistance from the Office in the preparation of a Meteorological Atlas of the Indian Ocean; the Council have sanctioned the temporary loan to the Utrecht Institute of the data books relating to the Indian Ocean which are in their possession.

Barometric Pressure Charts.

Charts of Barometric Pressure for the Atlantic, Pacific, and Indian Oceans.—These charts, which were referred to in the Report for 1884, have been completed, and are now in the hands of the engraver.

Current Charts.

Current Charts for the Atlantic, Pacific, and Indian Oceans.—The series of charts showing the temperature and barometer pressure over these oceans having been completed, the Council have decided to supplement them with charts of the currents, the materials for which are contained in the logs stored in the Office. These charts were commenced in January of the present year by Lieutenant Baillie and an assistant. It is hoped that they will not only be of great practical service to the mariner, but also of scientific interest in connexion with the charts of mean temperatures of the sea surface recently published. The charts are to be for each month of the year, and, in addition to the data available in the Office, a large amount of information will be obtained from the logs of H.M.'s ships and other documents.

Arctic meteorology.

Contributions to our Knowledge of the Meteorology of the Arctic Regions.—Part IV. of this work, completing the first volume,

was published during the year; a summary of its contents will be found in the last Report. The records now under discussion relate to the region situated near Behring's Straits.

Supply and Stock of Instruments.—In Appendix III. (p. 43) will be found a list of the meteorological instruments supplied by the Office to ships in the Royal Navy during the year, with a statement of the entire stock and distribution of instruments standing on the books, to the account of the Admiralty, on the 31st March 1886. Instruments belonging to the Office.

Appendix IV. (p. 44) gives similar information with regard to the disposal of the other instruments belonging to the Office, which are mainly supplied to the Mercantile Marine.

PART II.

Weather Telegraphy.

The service has been conducted without any serious interruption to its efficiency during the year. Changes at stations.

The Council have to regret the death of Mr. W. D. Penny, who had been reporter at Nairn for 25 years, having commenced the work at Christmas 1860.

The supply of self-recording aneroids to certain important stations, viz., Valencia, Scilly, Stornoway, Aberdeen, and Yarmouth, has been found to be very beneficial, as the reporters have by their use been enabled to note approximately the times of occurrence of considerable changes in pressure, and to keep an almost continuous record of their progress.

It is in contemplation to supply small hand anemometers on Robinson's pattern to some of the stations with a view to testing the expediency of substituting instrumental determinations of the velocity of the wind, for the non-instrumental estimates of force hitherto recorded.

A list of the telegraphic reporters will be found in Appendix V. (p. 45).

Inspection of the Telegraphic Reporting Stations.—The telegraphic reporting stations have been inspected during the year, in England (including Jersey and the Isle of Man) by the Rev. W. Clement Ley; in Scotland by Mr. Buchan; and in Ireland and Wales by Mr. Scott. The reports submitted by the Inspectors to the Council, which are printed in Appendix VI. (p. 46), show that the efficiency of the service has been fairly maintained. Inspection of the stations.

Discussion and Publication of the Information received.—A description of the practice of the Office in the collection, discussion, and dissemination of the meteorological information received by telegraph is given in Appendix VII. (p. 59). A list of the institutions and persons who received the Daily Weather Reports and Charts free of cost in 1885–6 forms Appendix VIII. (p. 69). Discussion of the reports.

Weather Forecasts.—There has been no material change in the system of preparation and issue of the forecasts during the year. Forecasts.

Synchronous weather charts.

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Weather Forecasts.—There has been no material change in the system of preparation and issue of the forecasts during the year. Forecasts.

Forecasts.

Forecasts are prepared three times a day, at 11h. a.m., and at 3h. 30m., and 8h. 30m. p.m. The Forecasts prepared at 11 a.m., on the information derived from the 8 a.m. reports, refer to the probable weather between noon on the day of issue and noon on the day following, and are publicly posted up in several places in London,* and supplied to the afternoon editions of the newspapers. The forecasts prepared at 8h. 30m. p.m. are mainly for the newspapers, but any of the forecasts are available for the information of persons requiring them.

Inquiries at the Office.

The inquiries received through the Post Office for special forecasts during the year amounted to 54, and the personal applications to 47. The rules of the Office relating to such inquiries continue the same as in previous years, and are given in Appendix VII. (p. 68).

Testing of the forecasts.

The results of a comparison of the Forecasts issued at 8 p.m. during the year with the weather actually experienced is given in Appendix XI. (p. 75), and the following summary of successes and failures, estimated in the manner explained in that Appendix, shows that the average of success over the whole United Kingdom has been 83 per cent, the figure being almost identical with that for the previous year, 82 per cent.

SUMMARY OF RESULTS OF 8 P.M. FORECASTS, 1885.

Districts.	Percentages.				Total percentage of Success.
	Complete Success.	Partial* Success.	Partial* Failure.	Total Failure.	
SCOTLAND, N. - -	55	31	9	5	86
„ E. - -	50	35	10	5	85
ENGLAND, N.E. - -	53	34	10	3	87
„ E. - -	53	31	11	5	84
MIDLAND COUNTIES -	51	34	11	4	85
ENGLAND, S. - -	57	31	9	3	88
SCOTLAND, W. - -	48	30	12	10	78
ENGLAND, N.W. -	48	32	12	8	80
„ S.W. -	50	32	12	6	82
IRELAND, N. - -	46	35	11	8	81*
„ S. - -	46	33	12	9	79
Summary - -	51	32	11	6	83

* Note "partial" implies "more than half."

Hay Harvest Forecasts.

Hay Harvest Forecasts.—The Council renewed in 1885 the offer made in the four previous years to the Royal Agricultural Society, the Royal Dublin Society, and the Highland Society to send daily Forecasts *gratis* during the hay season to a number

* Viz., in the City, at the Mansion House, Lloyd's Rooms, Messrs. R. & J. Beck's, Cornhill, and Messrs. Thos. de la Rue & Co's., Bunhill Row; in the West End, in the Libraries of the House of Lords and House of Commons; at Messrs. Elliot's, Strand; Messrs. Stanford's, Charing Cross; Messrs. Negretti & Zambra's, Regent Street; and Messrs. Pasterelli's, New Bond Street.

of observers selected by the Councils of those Societies, on the two conditions, that the information should be made as widely known as possible, and that a record should be kept of the value of each prediction and sent in weekly to the Office. The Societies again cordially accepted the proposal, and the following list of recipients was prepared:— Hay Harvest Forecasts.

LIST of those who received HAY HARVEST FORECASTS in 1885.

Districts.	To whom sent.	Address.
0. SCOTLAND, N.	Rev. Dr. Joass	Golspie.
	Major Smith	Munlochy, Inverness.
1. SCOTLAND, E.	G. Johnstone	Glamis, by Forfar.
	W. S. Macdonald	Craigielaw, Longniddry.
	A. F. Leslie	Braes Grange, Banffshire.
	C. W. L. Forbes	Aberfeldy.
2. ENGLAND, N.E.	J. Wilson	Chillingham Barns, Belford, Northumberland.
	J. Turner	The Grange, Ulceby.
3. ENGLAND, E.	W. Birkbeck	High House, Thorpe, Norwich.
	Sir J. B. Lawes, Bt., and J. H. Gilbert, Ph.D.	Rothamsted, Harpenden.
	F. Morrice	Ditchingham Hall, Bungay.
4. MIDLAND COUNTIES	Royal Agricultural College.	Cirencester.
	The Duke of Somerset	Gerrard's Cross, Bucks.
5. ENGLAND, S.	C. Whitehead	Barming House, Maidstone.
	E. P. Squarey	The Moot, Downton, Wilts.
6. SCOTLAND, W.	W. Calder	Castle Hill, Dalreoch, Dumbarton.
	M. J. Stewart	Ardwell, Stranraer.
	J. S. R. Ballingal	Eallabus House, Islay.
7. ENGLAND, N.W.	G. W. Wray	Leyburn, Yorkshire.
	The Earl of Derby	Knowsley Hall, Prescot.
	The Lord Egerton of Tatton.	Tatton Park, Knutsford.
8. ENGLAND, S.W.	Colonel J. B. Turbervill	Ewenny Priory, Bridgend, Glamorganshire.
	The Earl of Ducie	Whitfield, Falfield, R.S.O.
	T. Dyke	Long Ashton, Clifton, Bristol.
	R. Neville	Butleigh Court, Glastonbury.
9. IRELAND, N.	Viscount Massereene and Ferrard.	Antrim Castle, Antrim.
	Rev. A. Brown	The Manse, Hollymount, Co. Mayo.
	E. F. Farrell	Moynalty, Co. Meath.
10. IRELAND, S.	D. A. M'Cready	Larchvale, Moneygall, King's Co.
	D. A. Milward	Lavistown, Kilkenny.
	W. Talbot Crosbie, D.L.	Ardfert Abbey, Tralee, Co. Kerry.

Hay Harvest Forecasts.

The issue of the forecasts commenced on June 15 with those for England, E., the Midland counties, and England, S., and later those for other districts were added. The forecasts were issued daily (excepting on Sundays), and in most instances they were continued for about five weeks. In two or three cases, however, they were continued until the close of the wheat harvest; the additional expense of this extension being borne in one instance by the recipient.

The general result of this repetition of the issue of these forecasts, which began in 1879, is shown by the subjoined table, which has been compiled solely from the reports of the abovementioned gentlemen, and is entirely independent of any estimate formed within the Office itself:—

SUMMARY of RESULTS. HAY HARVEST FORECASTS, 1885.

Districts.	Names of Stations.	Percentages.				
		Complete Success.	Partial Success.	Partial Failure.	Total Failure.	Total percentage of Success.
SCOTLAND, N. -	Golspie and Munlochy - - -	48	40	6	6	88
„ E. -	Grange, Glamis Aberfeldy, and Longniddry.	57	31	11	1	88
ENGLAND, N.E. -	Belford and Ulceby - - -	60	18	19	3	78
„ E. -	Thorpe, Ditchingham, and Rothamsted	64	24	10	2	88
MIDLAND COUNTIES	Cirencester and Gerrard's Cross -	63	23	12	2	86
ENGLAND, S. - -	Maidstone and Downton - -	60	28	12	—	88
SCOTLAND, W. -	Dumbarton, Islay, and Stranraer -	51	23	21	5	74
ENGLAND, N.W. -	Leyburn, Prescot, and Knutsford -	51	23	21	5	74
„ S.W. -	Bridgend (Glamorgan), Falfield, Clifton, and Glastonbury.	63	24	11	2	87
IRELAND, N. - -	Antrim, Moynalty, and Hollymount -	49	27	17	7	76
„ S. - -	Moneygall, Kilkenny, and Ardfert -	50	27	18	5	77
	Mean for all districts, 1885 - -	56	26	15	3	82
	„ „ 1884 - -	43	43	12	3	85

The result of this year's checking shows that while, owing to a falling off in the number of *partial* successes, the general percentage was a little lower than in the preceding year, the proportion of *completely* successful forecasts (56 per cent.) was much greater than in 1884. The largest general per-centage (88) was reached in Scotland, N., Scotland, E., England, E., and England, S., while the smallest (74) was in Scotland, W., and England, N.W.

Two features in the forecast service of the year are deserving of special mention. The first of these was the establishment at

Hay Harvest Forecasts.

Ditchingham, in Norfolk, of a system of weather signalling, by means of which the forecasts were made known over a considerable area. The signals consisted of a ball, a drum, and a double cone, and were hoisted at about 5.30 p.m. each day, on the summit of Ditchingham Church tower, and remained up until the forenoon of the following day. The entire arrangements were organised and the expenses arranged for by F. Morrice, Esq., of Ditchingham Hall, who at the close of the time wrote as follows:—"The *signals* caused a wide difference of opinion as to their "utility, and some fierce opposition. On the whole I think they "were a great success. During the last week I shall call a meeting of farmers and others interested, and if they agree, I hope "another year to extend the system considerably, paying for our "own telegrams by subscription, and copying from one church "tower to another."

The other feature of interest in connexion with the service was the fact that there were this year several subscribers for the forecasts, one in England, E., two in the Midland counties, and one in England, N.W. These persons were unanimous in their testimony to the success and value of the system. The subscriber in England, E. (Mr. Fergusson), wrote:—"There has not been one mistake during the time I have had them." From the Midland counties one of the recipients (Mr. Harcourt Vernon) wrote:—"My agent informs me that they were wonderfully accurate, and of the greatest help to him and those of my "tenants who live near enough to use them." The other subscriber in this district (Lord Vernon) gave practical proof of his appreciation of the forecasts by depositing with the Office at the close of the time a sum of money towards defraying the cost of similar telegrams next year. The subscriber in England, N.W. (Mr. Earle), remarked that the forecasts had "answered every purpose."

Similar testimony to the value of the intelligence was borne by Mr. Jacob Wilson (Northumberland), and Mr. W. Birkbeck (Norfolk), while from Ireland (Co. Meath) Mr. Farrell wrote to say "they have been most useful in regulating farming operations."

Exhibition of Forecasts at post offices.

In reply to a question by Sir R. Paget, in the House of Commons on March 11th, 1886, Mr. Fowler stated that the Post Office had no objection to the exhibition of forecasts at local post offices, provided space was available, if the persons to whom these forecasts were addressed desired them to be so exhibited instead of being delivered.

Storm warnings.

Storm Warnings for the Coasts of the United Kingdom.—In Appendix X. (p. 73) will be found the names of the stations which are furnished with signals for Storm Warnings, in accordance with Circular 717 of the Board of Trade issued in February 1874.

These stations were, at the end of March 1886, 141 in number, situated:—

68 in England, 14 in Wales, 38 in Scotland, 15 in Ireland, 3 in the Isle of Man, and 3 in the Channel Islands.

Storm warnings.

The usual comparison has been instituted in the Office between the warnings issued in 1885 and the weather experienced on our coasts, the warnings being tested by the method explained in Appendix VII.(p. 69). The results of the comparison are shown in the following tables:—

RETURN of the Result of the Comparison between the Warnings issued and the Weather experienced in 1885.

Coasts.	Total No. of Orders to hoist and repetitions.	Warnings justified by subsequent Gales. Force 8 and upwards.	Warnings justified by subsequent strong Winds. Forces 6 and 7.	Warnings not justified by subsequent Weather.	Warnings late. Force 9 reached at two Stations before issue.	Warnings partially late. Force 9 reached at one Station before issue.	Warnings in Error owing to Telegraphic mistake.	Storms for which no Warning was issued.
Ireland, South -	74	47	16	10	—	1	—	Jan. 28, Feb. 6, April 5.
„ East -	79	32	27	20	—	—	—	April 5.
Scotland, East -	65	42	13	9	—	1	—	April 20,* Sept. 30, Oct 1.*
„ West -	56	29	14	12	—	1	—	——
England, North-west	78	39	18	19	1	1	—	Jan. 28.†
„ West -	65	41	10	12	—	2	—	Oct. 4.
„ South -	79	46	18	15	—	—	—	Feb. 8,‡ Aug. 12‡, Oct. 4.
„ South-east	36	24	6	6	—	—	—	——
„ East -	59	27	20	12	—	—	—	——
Totals - -	591	327	142	115	1	6	—	
Per-centages -	—	55·3	24·0	19·5	0·2	1·0	—	

* These gales were not felt south of Aberdeen.
† Warnings too late to be of practical use.
‡ Warnings issued to Devon and Cornwall; gale extended up Channel.

NOTES, as to the GALES NOT WARNED for, in 1885.

January 28.—*Gale in Ireland, S., and England, N.W.*—There was no definite indication of this at 6 p.m. 27th, and its advance was so rapid that at 8 a.m. 28th, the centre of depression was close to Mullaghmore. At Valencia the maximum force occurred at 4 a.m. 28th.

February 6.—*Gale in Ireland, S.*—No indication at 6 p.m. 5th, when the barometer was still rising in the West, with moderate Westerly breezes. Depression advanced so rapidly that Valencia had extreme force at 3 a.m. 6th.

February 8.—*Gales in England, S.*—The south-west coasts of England were warned on 7th, and at 8 a.m. there was no indication of the gale spreading up-Channel. During the day, however, a remarkable local disturbance was developed over the Irish Sea, and the gale subsequently spread all over England. The 8th, being a Sunday, there were no 2 p.m. reports, and no "special" telegrams could be obtained, or the Channel might have been warned.

Storm warnings.

April 5.—Gale in Ireland, S. and E.—There were no indications whatever at 6 p.m. 4th, of advance of this gale.

April 20.—Gale in Scotland, E. (north of Nairn).—Strong winds were anticipated, and mentioned in the forecasts; the forecaster can see no sufficient reason in the conditions prevailing prior to the gale for anticipating its occurrence to the northward of Nairn.

August 12.—Southerly Gale in England, S.—Strong winds were anticipated, and mentioned in the forecasts; the depression, however, moved in a more easterly direction than was anticipated, and the gale spread up the Channel.

September 30 and October 1.—Gale in Scotland, E.—The depression advanced so much more rapidly than was expected that, although the west of Scotland was warned on 29th, the east was not, and the gale spread to that coast during the earlier part of the 30th.

October 4 (night).—Gale in England, S.—The forecaster reports:—"On looking over the charts again I cannot see why "the gale should have occurred. Apparently a very shallow "local depression moved eastwards over our southern counties, "but could scarcely have been expected to cause so much wind "with the moderate gradients which existed previously."

Comparison of results for 1885 with previous years.

The following table contains a comparative statement of the storm warnings and their results in 1885, and in the ten preceding years. It will be seen that the percentage of warnings justified is seven less than in the preceding year:—

Years.	Total No. of Warnings issued.	Warnings justified by subsequent Gales.	Warnings justified by subsequent strong Winds.	Total Warnings justified.	Warnings not justified by subsequent Weather.
1875	248	41·1	35·1	76·2	21·0
1876	265	61·1	21·5	82·6	11·7
1877	475	53·3	25·9	79·2	16·4
1878	485	56·7	20·8	77·5	17·9
1879	509	50·5	25·1	75·6	20·6
1880	390	58·2	24·6	82·8	13·3
1881	454	58·6	23·3	81·9	14·8
1882	503	61·4	21·1	82·5	14·9
1883	610	56·2	21·6	77·8	20·8
1884	461	66·4	20·0	86·4	12·1
1885	591	55·3	24·0	79·3	19·5

The Prevalence of Gales on different Parts of the Coast.—At the suggestion of the Hydrographer tables have been prepared giving the relative frequency of gales according to four quadrants (N. to E., E. to S., &c.) on different districts of the coast. The tables refer to the period of 15 years, 1871–1885.

Fishery barometers.

Fishery Barometers.—In connexion with the subject of storm warnings, the supply of public barometers to fishing stations and other places on the coast may be mentioned. The whole number

Fishery barometers.

of stations supplied with these instruments by the Office is at present 169. Of these stations, 60 are in England, 5 in Wales, 46 in Ireland, 54 in Scotland, 3 in the Isle of Man, and 1 in Jersey. The list is given in Appendix IX., p. 72.

Observations on Ben Nevis.

Observations on Ben Nevis.—The arrangements with the Directors of the observatory established on the summit of Ben Nevis, at a height of 4,000 feet above the sea, detailed in the last Report, have been continued during the year. The Council have continued the annual grant of 100*l.* towards the expenses of the observatory, and have received MS. copies of all the meteorological observations taken, and in addition occasional telegrams, 20 in number.

Atlantic telegrams.

Atlantic Telegrams.—The service as described in the last Report has been maintained during the year, and some improvements have been made in the system of reporting (*see* Appendix VII., p. 61).

It may be interesting to repeat here that the expense of these telegrams is borne conjointly by the Central Meteorological Office in Paris, and by the Council. The Chief Signal Office at Washington, under General Hazen, co-operates cordially in the scheme, and has instructed its agents at New York and Boston to collect from incoming steamers, and to transmit to London by telegraph, reports of storms met with west of the meridian of 45° W., as well as of ice or derelict ships seen on any part of the voyage, the latter classes of information being of especial importance to seamen.

Forms are issued to captains of the fast steamers that cross the Atlantic from England, which they are requested to forward to the Signal Office agent on arrival at either of the ports named, and a system of telegraphing has been arranged with the Signal Office. The service was commenced in November 1884.

During the twelve months ending with March 1886, 161 telegrams have been received, of which 83 contained reports of weather, 85 of ice, and 7 of derelict ships.

The general question of the utility of these telegrams as aids to the forecasts of weather is under consideration, and a proposal for their extension so as to embrace a general view of the chief meteorological data over the whole of the United States of America, for every day, which may be made available for all European meteorological administrations, is receiving attention.

The Chief Signal Office has applied for a daily telegraphic report from Valencia, to be forwarded to Washington, and the Council have given instructions for this to be sent.

Publications.

Publications.—The Weekly Weather Report has appeared in its enlarged form, as explained in the last Report, and has been further improved by the addition since 1st January 1885, of two new columns on the last page of each report, giving the number of day-degrees of accumulated heat, both above and below 42° F.,

for each station, in addition to the values for each district which appear on the first page. Publications.

Since January 1, 1886, several other columns have been added to the summary on the first page, showing the difference between the aggregate values for Accumulated Heat, Rainfall, and Bright Sunshine during the current year, and the means for the corresponding periods during the eight years 1878–85. The Rainfall averages have also been greatly improved, as they now refer to the observations for 20 years (1866–85). The Quarterly Summary, issued as an Appendix, gives the Weekly and Progressive values of the same elements for all the districts in each month of the current year—in continuation of the Tables published in Appendices I. and II. for 1884.

The Monthly Weather Report has also appeared regularly.

Simultaneous Observations.—The Office has continued its co-operation in the system of simultaneous observations, taken once in every 24 hours, which was organised in 1874, at the request of the Chief Signal Officer of the United States. Simultaneous observations.

The list of observers on this system at land stations for 1885 is given in Appendix XII., p. 80.

A form for the entry of the simultaneous observations is bound up with every ship's log issued by the Office. In previous Reports it has been stated that the Lords Commissioners of the Admiralty had, at the request of the Council, issued instructions for these observations to be taken (in addition to those made by the Service Regulations) on board each detached ship-of-war on foreign service; or, in the case of a squadron acting together, on board the ship of the senior officer. The number of these observations which have been received during the year from the Royal Navy has been 7,580, and from the Mercantile Marine, 6,270.

PART III.

Land Meteorology of the British Isles.

Observatories and Stations.—Records of the climate of the British Isles are received by the Office from certain stations with different degrees of fulness of organisation, which may be arranged in five classes.

1. The Observatories furnished with self-registering instruments by which all the principal meteorological phenomena are recorded continuously, and which thus afford materials for the study of the periodic variations of the meteorological elements. Self-recording observatories.

2. Anemographic stations furnished with instruments registering the wind only. The records from these stations relate to Anemographic stations,

weather as distinguished from climate, and are especially useful in connexion with the passage of storms, and as affording evidence available in the courts of law with respect to collisions at sea, and damage done by wind.

Stations of Second Order. 3. Stations of the Second Order furnishing climatological information from eye observations taken twice a day. The observers at these stations are all volunteers.

Telegraphic Reporting Stations. 4. The Telegraphic Reporting Stations at which eye observations are taken, supplemented in some cases by self-recording aneroids, &c., forming the material upon which the daily weather reports and forecasts are based. The hours of observation at these stations are limited by the requirements of the telegraphic system, as explained in Part II., but the data which they furnish are utilized to afford climatological information for parts of the country where Stations of the Second Order do not exist.

Extra stations. 5. Extra stations furnishing returns with less completeness, and with less detail than those of class 3.

Sunshine stations. A continuous record of the amount of bright sunshine is also received from 35 stations in the British Isles, some of which are first or second order stations, whilst from others the sunshine record is alone received.

A fuller account of these several stations and of the methods employed by the Office in dealing with the records they respectively furnish will be found in Appendix XIII., p. 81.

Documents received. Appendix XIV., p. 85, contains a list of all documents relating to the land meteorology of the British Isles received at the Office during the year.

Changes in the observatories. The instruments were transferred from the old to the new observatory at Falmouth at the commencement of May 1885, and the records have been continued without more than a few days' interruption.

At Glasgow, Professor Grant has succeeded in completing the arrangements for continuing the records of the self-recording instruments by the aid of the Town Council and the Clyde Trustees. The observations have been maintained by Professor Grant since the end of the year 1884 at his own expense. The Meteorological Council have also undertaken to grant a sum of 75*l.* annually towards the cost of this observatory, in return for which they receive copies of the records, as well as returns for the Weekly Weather Reports and observations from a Second Order Station.

The anemograph at Sandwick was removed in December to Swanbister in the parish of Orphir, in the same island, where Mr. W. I. Fortescue has kindly undertaken to continue the record.

The anemograph at Seaham Harbour having been found to be out of order, the Council have determined to remove it from that

station, and to erect it, when repaired, at North Shields, where the Town Council have kindly offered them a suitable site.

Inspection of the Stations.—The self-recording observatories and the anemographic stations (Classes 1 and 2), as well as the Telegraphic Reporting Stations (Class 4), are regularly visited each year by the Inspectors of the Office, before mentioned (p. 9). The extra stations (Class 5) are inspected as opportunity offers. Of the Stations of the Second Order (Class 3), some belong to the Royal Meteorological Society; these are visited by an Inspector appointed by the Society, an allowance being made by the Office toward the cost of the inspection, in accordance with the recommendation of the Treasury Committee (1877). The remaining Stations of the Second Order, which are in immediate connexion with the Meteorological Office, are visited at least once in every two years by the Inspectors of the Office. The Superintendent of the Kew Observatory, Mr. G. M. Whipple, is specially employed to inspect and report on the self-registering apparatus, and on the photographic processes at the observatories. Extracts from the Reports of the Inspectors will be found in Appendix VI., p. 46. Inspections.

Information supplied to the General Register Office, Dublin.—Reports from nine of the Irish stations of the Office have been regularly supplied to the Registrar General for Ireland, for use in his Weekly and Quarterly Returns. Reports supplied to Registrar General for Ireland.

Quarterly Weather Report.—Part IV., completing the volume for 1877, has been issued, and good progress has been made with that for 1878. Publications.

The volume of the Monthly Weather Report for 1885, and the parts of that for 1886 have appeared up to date. This publication takes the place of the Quarterly Weather Report.

The publication of the Hourly Readings for 1883 is nearly completed.

Reports from Stations of the Second Order.—The volume for 1881 has appeared, and that for 1882 is in hand.

The Harmonic Analyser.—The analysis of the thermograms for 1882 has been completed, and the results for the 12 years 1871–82 will appear in the volume of Hourly Readings for 1883. The barograms are now being dealt with and are finished up to the end of 1872. Harmonic Analyser.

As it seems desirable that the success of the Harmonic Analyser should be generally known, a paper describing the principal results obtained, and a determination of the trustworthiness of the computations will shortly be read before the Royal Society.

Electric Anemometer.—Frequent alterations were necessary to meet the difficulties which occurred before the trial instrument could be made to work satisfactorily at Kew. Success has now been Electric Anemometer.

attained, and the Council are endeavouring to arrange with the telegraph authorities for mounting it on the hill above the observatory at Valencia, and keeping its connexions with the station in repair. The observatory is much sheltered on the north-west side, and observations of wind taken there are not satisfactory, but it seems likely that the results obtained with the electric anemometer in the proposed position will be of much value for the weather forecasts.

Movement of Clouds.—See Note A., p. 22.

Eruption of Krakatoa.

Eruption of Krakatoa —The discussion of the large amount of data which has been collected, relative to the remarkable air-wave caused by the great explosion that occurred at the end of the volcanic eruption of Krakatoa, in August 1883, is now completed, and the report, accompanied by several illustrative diagrams, will shortly be submitted to the Committee appointed by the Royal Society to collect information relating to the eruption.

The results may be accepted as indicating with considerable precision the moment of the final explosion, which is now determined to have occurred a few minutes before 10 a.m., local Krakatoa time, of the 27th August 1883; and they confirm generally the approximate determinations of the velocities of the wave's passage round the earth before obtained and laid before the Royal Society.

The Helm Wind.

The Helm Wind Enquiry.—The Royal Meteorological Society having expressed a desire to institute observations into the phenomena accompanying the peculiar wind of the Eden Valley in Cumberland, called the "Helm Wind" of Cross Fell, and having applied to the Council for assistance in this research, a supply of instruments has been lent to the Society for use when the Helm Wind is prevalent.

Library.

Library.

The library contains standard works on Meteorology and the allied sciences. It consists at present of about 9,400 volumes and pamphlets, exclusive of charts and MS. records of observations. The books and other documents are accessible to scientific men.

Appendix XV., p. 90, contains a list of the accessions to the library during the year. These have been catalogued upon cards as before, besides being entered in the reference catalogues under (1) Authors, and (2) Subjects.

Expenditure.

Financial.

Appendix XVI., p. 114, shows the receipts and payments during the year ending 31st March 1886. The amount voted by Parliament was 15,300*l.*, as in the previous year.

The following abstract of expenditure shows the amount *properly chargeable* to the year in question, and its distribution under the

various heads, together with the increase or decrease in 1885–86, as compared with the previous year :—

Net Expenditure.	1884-85.			1885-86.			Increase.			Decrease.		
General Administration.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Payment of Council -	1,000	0	0	1,000	0	0	—			—		
Secretary - -	800	0	0	800	0	0	—			—		
Office - - -	758	16	0	769	19	0	11	3	0	—		
Rent, fuel, and lighting -	716	8	2	707	5	10	—			9	2	4
Alterations to premises, attendance, and contingencies - -	424	5	9	403	14	8	—			20	11	1
Expenses incidental to International Meteorological Congress -	—			17	18	4	17	18	4	—		
Pensions - -	42	16	4	42	16	4	—			—		
Special Researches -	989	8	2	728	7	6	—			261	0	8
Land Meteorology -	3,051	1	9	3,160	1	6	108	19	9	—		
Weather Information -	4,066	6	10	3,984	15	7	—			81	11	3
Inspections - -	560	12	1	549	9	9	—			11	2	4
Ocean Meteorology -	2,445	6	2	2,845	18	3	400	12	1	—		
Total - £	14,855	1	3	15,010	1	9	538	8	2	383	7	8

(Signed)

R. STRACHEY,
Chairman of the Council.

NOTE A.

Memorandum on Cloud Photography by Professor Stokes, F.R.S.

The Council have now obtained a series of cloud photographs taken with cameras at two stations at a distance of 800 yards. Each observation involves four photographs, one pair taken simultaneously at the two stations respectively, and another pair taken about a minute after the former. The object was to determine the height, direction of motion, and velocity of various clouds.

In the observation the cameras are set to correspond, so that the lines of collimation in taking the four photographs are in the same direction, save as to certain small corrections of the nature of index errors. A selection is made of cloud-points which can be identified, and these are marked on the four photographs. The co-ordinates of the marked points, referred to vertical and horizontal lines shown on the photograph, can be measured, when it becomes a question of calculation only to determine the position of a cloud-point, both for the first and second moments of observation, and consequently to determine not only its height, but the direction and velocity of its motion. At either moment the photographs determine the two lines of sight for the cloud-point, as seen from the station respectively. If the identification be correct, these lines ought to intersect, which would give a relation between the four observed quantities, namely, the altitudes and azimuths of the cloud-point as seen from the two stations; accordingly three of these observed quantities suffice for the determination, and then the fourth affords a verification.

The requisite formulæ for the reduction are readily obtained from spherical trigonometry. The calculation is perfectly straightforward, and there would be no difficulty about it if we had only a small number of cloud-points to reduce.

It is very desirable, however, to have numerous observations, and to determine, at least at first, a considerable number of cloud-points for each. The calculation, however, as above indicated, though straightforward, is by no means short; and the labour and consequent expense of making very numerous reductions in this manner would be almost prohibitive. Accordingly an endeavour has been made to simplify the process, and a method has been devised which promises to give the results with very little trouble, and at the same time very accurately.

It would be premature to describe this method at length until it shall have been actually put in practice. Suffice it to say that paper positives are taken from the glass negatives, and the cloud-points are marked on them. The four positives are laid in succession on a piece of paper on which a pair of cross-lines had previously been drawn, a correction being made for index errors by slightly shifting the positive from the position in which the cross-lines on it would be in a line with the cross-lines on the paper below. The places are then copied by pricking through.

The lower paper now contains the record of the whole observation, cleared of index errors.

It is easy then to pass the projection of the cloud-points on a plane parallel to the plates, to a projection on a horizontal plane in the following manner:—A wooden frame is prepared containing (1) a lens or combination of short focus with its axis horizontal; (2) a vertical frame, or board with a window, at a horizontal distance from the focus of the lens equal to the focal length of the objective of the camera; (3) a drawing board moveable round a horizontal axis intersecting at right angles the axis of the instrument, and capable of being clamped at any desired angle to the verticle frame.

The drawing board is set at an angle to the vertical equal to the zenith distance of the line of collimation, in the set of observations to be reduced, and the pricked paper is fastened by drawing pins to the vertical frame, the four arms of the cross having been previously marked by pricking through. A piece of paper having been pinned on to the drawing board, the sun's light is reflected into the lens, and the operator marks the centres of the spots of light corresponding to the various holes. This can be done with the utmost precision, if the pin or needle used for pricking has the proper diameter to give, as a result of diffraction, a very fine black centre in the middle of the illuminated patch.

When the four marked points corresponding to the four observations on any one cloud-point are joined, a quadrilateral is formed, two opposite sides of which, if there be no error of observation, will be parallel to each other and to the line joining the stations. If, moreover, the cloud be not moving up or down, but only in a horizontal plane, the sides above mentioned will be equal, and the quadrilateral will be a parallelogram. Two opposite sides represent the drift on the same scale on which the other two sides represent the base line of 800 yards, so that the magnitude and direction of motion are in a matter represented to the eye. Moreover, the height is given by the simple expression P cos $z_0 \div p$; where P is the product of the base and the horizontal distance from the focus of the lens to the drawing board, which accordingly is always the same, z_0 is the zenith distance of the line of collimation, and is therefore the same for all the cloud-points belonging to the same set, and p is the base side of the parallelogram belonging to any particular cloud-point which is parallel to the base. The calculation is accordingly extremely easy; and, moreover, an inspection of the different figures shows at once the relative heights of the different cloud-points, since the heights are inversely as the parallel sides of the corresponding parallelograms.

The photographs hold out the prospect of giving very good results. It is to be remembered that there is no object in extreme accuracy; what we want is rather numerous observations, so as to get a general insight into the movements of the air at different heights, and under different circumstances.

APPENDIX.

APPENDIX I.

LIST of CAPTAINS (and Officers) who have sent in Logs classed as "Excellent" during the year ending March 31, 1886. The figures opposite to each show the total number of such Logs which they have returned to the Office during the period that they have been observing.

Captain's Name.	Number of "Excellent" Logs.	Ship.
Adamson, A. W. - -	1	S.S. "Brindisi."
Aldrich, Pelham, R.N. -	10	H.M.S. "Sylvia."
Atkinson, S. P. H. - -	1	"Edmonton."
Balfour, Lieut. Andrew, R.N. -	16	H.M.S. "Magpie" and H.M.S. "Rambler."
Barker, Mr. D. W., F.R.Met.Soc.	8	"Superb," S.S. "International," and S.S. "Dacia."
Barlow, B. J. - - -	11	S.S. "Tainui."
Becket, Alexander - -	8	"Amana."
Bennett, E. C. - - -	11	"Thessalus."
Beresford, Lieut. C. de la Poer, R.N.	7	H.M.S. "Dart."
Bouchette, Francis Baines -	6	S.S. "Montreal."
Brown, E. - - -	1	"Moorhill."
Buchan, James - -	18	"Coppename."
Burton, George - -	3	"British Prince" and "British Crown."
Campbell, Archibald - -	15	S.S. "Circassia."
Campbell, James - -	4	"Florence."
Carr, H. C. - - -	1	"Superb."
Clapp, Staff Comr. E. S., R.N.	1	L.H. Tender "Richmond."
Clarke, James - - -	5	S.S. "Olbers."
Crutchley, William Caius, R.N.R.	10	S.S. "Ruapehu" and S.S. "Kaikoura."
Cummings, William - -	1	S.S. "Dracona."
Dart, Leonard C. - -	6	"Alcester."
Davies, Joseph - -	1	S.S. "Archimedes" and S.S. "Flaxman."
Davison, H. - - -	2	S.S. "Oceanic."
Denham, George - -	7	S.S. "Erl King" and S.S. "Ocean King."
Deuchars, William - -	4	S.S. "Jan Mayen."
Donaldson, R. A. - -	3	S.S. "Glenavon."
Dunbar, John Ivor - -	5	S.S. "Arracan."
East, Lieut. James H. C., R.N.	5	H.M.S. "Myrmidon."
Ellery, William - -	15	"Majestic."
England, Thomas - -	4	"Jane."
Fraser, W. D. - - -	1	"Thomas S. Stowe."
Freeman, G. A. - -	1	"Hannah and Mary."
Freeman, Thomas William -	20	S.S. "Bellerophon."
Flinton, Benjamin - -	1	"Dartmouth."
Fullarton, D. - - -	2	"Timaru."

Captain's Name.	Number of "Excellent" Logs.	Ship.
Gordon, James	8	S.S. "City of Agra."
Graham, W. Vincent	2	"Bowfell."
Gray, David	12	S.S. "Eclipse."
Grey, Charles	2	"MacMillan."
Halley, Edward	2	"City of Madras."
Havergal, Lieut. A., R.N.	7	H.M.S. "Sylvia."
Hayward, G. O.	8	S.S. "Durley" and S.S. "Dunrobin Castle."
Heyman, Sub.-Lieut. G. A., R.N.	2	H.M.S. "Myrmidon."
Hird, William	2	"Marlborough."
Holdich, John Peach, R.N.R.	10	"British Envoy."
Hoskyn, R. F., R.N.	10	H.M.S. "Myrmidon."
Howard, Lieut. W. Van Sittart, R.N.	4	H.M.S. "Flying Fish."
Hughes, W. P.	7	"Laomene."
Irving, P. J.	8	S.S. "Republic."
Jeffery, Arthur W.	8	S.S. "Teniers."
Kellett, Arthur	2	S.S. "Calabria."
Kennedy, C. W.	8	S.S. "Germanic."
Ladd, Mr. Richard, F.R.A.S., F.R.Met.Soc.	14	S.S. "Scotia" and S.S. "Minia."
Lailey, William Nicholson	7	S.S. "Derwent" and S.S. "Boyne."
Lambert, H. M., Sub-Lieut., R.N.R.	1	S.S. "Brindisi."
Lewis, B. C.	1	"British Merchant."
Lowe, James	1	"Agnes Muir."
Lugar, W. R.	2	S.S. "Mackay-Bennett."
Lyne, Sub.-Lieut. W. O., R.N.	2	H.M.S. "Flying Fish."
McDougall, Alexander	4	"Auckland" and S.S. "Chittagong."
McLean, Archibald	1	S.S. "Titania."
Maclear, J. F. L. P., R.N.	13	H.M.S. "Flying Fish."
McMillan, John	1	"Canterbury."
Manning, Henry	9	S.S. "Seine."
Maxwell, Joseph	1	"Oamaru."
Mesnard, Thomas	4	"Sierra Miranda."
Metcalfe, John	9	S.S. "Oceanic."
Milne, W. F.	8	S.S. "Esquimaux."
Moignard, P.	1	"Allonby."
Molony, E. J.	4	"British Merchant."
Moore, W. U., R.N.	6	H.M.S. "Dart" and H.M.S. "Rambler."
Murdoch, Peter	7	"Sierra Estrella."
Nicholson, Malcolm	4	"St. Vincent."
Norman, Francis	4	"Polestar."
Parry, Moses	8	S.S. "Prydain."
Parsell, Henry	9	S.S. "Adriatic."
Parson, George Fry	5	"Earnock."
Pearson, Charles William	25	S.S. "Strathleven."
Peebles, Robert	10	"Tweedsdale."
Plater, H. R. F.	1	"Patriarch."
Pomeroy, H.	2	"Elissa."
Potter, Thomas	3	S.S. "Durham."
Prout, John Cawse	4	"Cape St. Vincent."

Captain's Name.	Number of "Excellent" Logs.	Ship.
Quaile, D. W. A. - -	1	"Orissa."
Randall, William - -	8	"Dynomene."
Renaut, Charles Henry -	15	"Pleione."
Rosseter, William Lawrence -	6	"St. Kilda."
Russell, Charles James -	5	"Candahar."
Sangster, William - -	3	S.S. "Dracona."
Sargent, A. H. - - -	1	"Glenlora."
Savage, Lieut. W. M., R.N -	3	L.H. Tender "Richmond."
Scott, George - - -	2	"Iolanthe."
Scott, William - -	16	"Commewyne."
Sheldrake, J. W. - -	1	"Iron Cross."
Simpson, Alexander - -	3	S.S. "Australasian."
Simpson, Alexander - -	16	"Traveller."
Spratley, W. - - -	7	S.S. "Mozart."
Sturdee, H. King - -	4	L.H. Tender "Richmond."
Thomson, A. S. - -	6	S.S. "Dacia."
Tindall, W. A. - -	1	S.S. "International."
Trant, W. H. - - -	3	S.S. "Venetian."
Travers, H. de la Cour -	3	S.S. "Tartar."
Trott, Samuel - - -	6	S.S. "Minia."
Vereker, Comr. Hon. Foley C. P., R.N.	7	H.M.S. "Magpie" and H.M.S. "Rambler."
Walker, Henry - -	5	S.S. "Cephalonia."
Watson, Alexander - -	2	"Elvira."
Whall, W. B. - - -	2	S.S. "Lapland."
Wheaton, N. J. - -	3	"Eliza."
Wilson, John - - -	1	S.S. "Ethiopia."
Wilson, William - -	2	"Horsa."
Youlden, H. - - -	5	"May Hulse."

Names of observers deceased printed in italics.

APPENDIX II.—Ships supplied and Documents returned during the year ending 31st March 1886.

The number of merchant ships supplied with standard instruments and meteorological logs during the above period was 141.

The number of meteorological logs, and documents from Foreign Stations, received during the same period, and registered in the Office, amounted altogether to 290, of which 194 were returned from ships, and the remainder from land stations, outside the British Isles.

List of Documents received from Foreign Land Stations.

Place.	Observer.	No. of Documents.	Nature of Observations.
Abaco (Bahamas) -	G. L. Nairn, Lightkeeper -	1	"Lighthouse" Register, January to June 1885.
Aden - - - -	Capt. W. K. Thynne, Port Officer.	1	Report on cyclone in Gulf of Aden on June 3, 1885.
Barbados (Commercial Hall) -	C. T. Clark and T. L. Ince -	2	"Lighthouse" Register, January to December 1885.
„ (Joe's River House) -	R. B. Walcott, M.D., F.R. Met. Soc.	2	„ „ „ „ „ „
Bermuda - - - -	Sergt. J. Green, Medical Staff Corps.	5	Anemograms, March to December 1885.
Beyrout (Lee Observatory) -	R. H. West - - -	12	Two observations daily, March 1885 to February 1886.
Breaksea Island (King George's Sound).	W. Lindfield, Lightkeeper -	1	"Lighthouse" Register, January 1884 to June 1885.
Cape Juby (North-West Africa) -	S. Morris - - -	11	Two observations daily, February 1885 to February 1886.
Cape Pembroke (Falkland Islands)	G. K. Broom, Lightkeeper -	2	"Lighthouse" Register, January to December 1885.
Cay Lobos (Bahamas) - -	R. A. A. Espie and H. J. Fountain, Lightkeepers.	2	„ „ July to December 1884, and July to December 1885.
Cay Sal (Bahamas) - -	T. R. Thompson, Lightkeeper	3	„ „ July 1884 to December 1885.
Famagusta (Cyprus) - -	G. Eliades - - -	2	Two observations daily, May and June 1883.

List of Documents—*continued.*

Place.	Observer.	No. of Documents.	Nature of Observations.
Gibraltar	Corpl. T. W. Jent, Med. Staff Corps.	12	Two observations daily, March 1885 to February 1886.
Heligoland	Lightkeepers	11	Eight observations daily, March 1885 to February 1886 (except May 1885).
Inagua (Bahamas)	N. H. E. Garner, Lightkeeper	1	"Lighthouse" Register, January to June 1885.
Indian Ocean	C. Meldrum, LL.D., F.R.S.	1	Tracks of cyclones in the Indian Ocean in the years 1856-57; 1860-61; 1867-68; 1871-72; 1879-80; and 1884.
Kyrenia (Cyprus)	E. Joannides	2	Two observations daily, May and June 1883.
Larnaca (Cyprus)	A. Tsepis	2	" " " " " "
Limassol (Cyprus)	Luigi Béraud	2	" " " " " "
Nicosia (Cyprus)	A. Kyriakides	2	" " " " " "
Papho (Cyprus)	E. A. Malliotis	2	" " " " " "
Point King (King George's Sound).	S. Mitchell	1	"Lighthouse" Register, January 1884 to June 1885.
Sombrero	J. A. Richardson, Lightkeeper	2	" " December 1884 to November 1885.
Suva (Fiji)	J. D. W. Vaughan	12	One observation daily, December 1884 to December 1885.
Tonga (Tubou College)	J. E. Moulton	1	Three observations daily, June 1875 to November 1880.
Trebizond	——	1	Monthly abstract of three observations daily, 1880-84.

List of Documents received from Ships.

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
[1] Adamson, A. W. -	S.S. Brindisi - -	2,143	P. & O. Steam Navigation Co., London.	To and from Calcutta, viâ Suez -	1885–86
[2] Alderton, Thomas -	S.S. Nepaul - -	1,988	" " " -	Two voyages between Gibraltar and Calcutta, viâ Suez - - -	1884–85
[3] " " -	" -	"	" " " -	To Bombay, China, and home, viâ Suez	1885
Aldrich, Pelham, R.N.	Sylvia - -	1,050	H.M.S. - - - -	Abstract of observations, and remarks on wind and weather on the coast from Durban to Delagoa Bay -	1884
" " -	" - -	"	" - - - -	Surveying off Cape of Good Hope, and voyage to St. Helena, Gibraltar, and Malta - - - -	1884–85
" " -	" - -	"	" - - - -	Surveying off Cape of Good Hope, and voyage to St. Helena - -	1885
[4] " " -	" - -	"	" - - - -	From St. Helena to Gibraltar and Malta, and observations while in port - - - - -	1885
Atkinson, S. P. H. -	Barque Edmondton -	1,298	J. Ross, Liverpool - -	To Acapulco, Iquique, and home -	1884–86
Balderston, R. J. -	Belfast - -	1,865	R. Brocklebank, Liverpool -	To and from Calcutta - - -	1884–85
[5] Barker, D. W., F.R. Met. Soc.	S.S. Dacia - -	1,473	India Rubber and Gutta Percha Tel. Works Co., London.	To Karachi and Antwerp, viâ Suez -	1885–86
[6] Barlow, Brabazon J., R.N.R.	S.S. Tainui - -	3,261	Shaw Savill and Albion Co., Lim., London.	To Cape Town, Hobart, Lyttelton, Rio Janeiro, and home - - -	1885
" "	" - -	"	" " " -	To Cape Town, Hobart, Port Chalmers, Rio Janeiro, and home - -	1885
[6] " "	" - -	"	" " " -	To Cape Town, Wellington, Rio Janeiro, and home - - -	1885–86
[7] Barrett, Thomas -	Barque Craigburn -	1,997	R. Shankland, Greenock - -	To and from Calcutta - - -	1885–86
" " -	Glenburn - -	1,476	" " - -	" " - -	1884–85

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
Becket, Alexander -	Amana - -	1,299	J. Smith, Glasgow - -	To Portland (Oregon), Havre, and home - - - -	1884–85
„ „ -	„ - -	„	„ „ - -	To Colombo, Cochin, and home -	1885–86
Belding, Rawstin -	Barque Pacific -	429	B. R. Hennessy, Swansea -	To and from Chile - - -	1884–85
Bence, J. F. - -	Barque Caldbeck -	747	W. H. Nicholson, Liverpool -	From Lat. 0°·1 N. Long. 26° W. to Valparaiso - - - -	1883
Bennett, E. C. -	Thessalus - -	1,782	T. Carmichael, Greenock -	To Sydney, San Francisco, Newcastle (N.S.W.), San Francisco, Queenstown, and Hull - - -	1884–85
Bennett, W. H. -	Loch Venachar -	1,485	J. P. Kidston, Glasgow - -	To and from Melbourne - -	1885–86
Bouchette, F. B. -	S.S. Montreal - -	3,308	Mississippi & Dominion S.S. Co., Lim., Liverpool.	Four voyages to and from Halifax (N.S.) - - - -	1884–85
„ „ -	„ -	„	„ „ - -	Five voyages to and from Quebec -	1885
Brehant, G. J. -	Barque Achievement -	499	J. Barker, Liverpool - -	To Autofagusta and Trieste - -	1884–85
Brown, E. - -	Barque Moorhill -	484	E. Brown, Liverpool - -	To Colon (Aspinwall), Galveston, and home - - - -	1885–86
Brown, James -	S.S. Elysia - -	1,745	A. C. Henderson, Glasgow -	Two voyages to and from Boston -	1885
Buchan, James -	Barque Coppename -	316	J. C. Pearson, Glasgow - -	To and from Bahia - - -	1885
„ „ -	„ -	„	„ „ - -	„ „ Surinam - - -	1885–86
Burton, George -	S.S. British Crown -	2,548	British Shipowners Co., Lim., Liverpool.	Five voyages to and from Philadelphia -	1884–85
„ „ -	„ -	„	„ „ „ -	Three „ „ „ -	1885
Calligan, M. -	S.S. - -	471	Waterford S.S. Co., Lim., Waterford.	Trading between Liverpool, Waterford, and Bristol - - - -	1885
„ „ -	S.S. Zephyr - -	411	„ „ „ -	„ „ „ „ -	1885
„ „ -	„ - -	„	„ „ „ -	„ „ „ „ -	1885
[a] Campbell, Archibald	S.S. Circassia - -	4,272	The Barrow Steam Ship Co., London.	Four voyages to and from New York -	1884–85

LIST of DOCUMENTS, &c.—*continued.*

	Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year
8	Campbell, Archibald	S.S. Circassia	4,272	The Barrow Steam Ship Co., London.	Five voyages to and from New York	1885
	Campbell, James	Barque Florence	436	J. T. Cowley, London	To Buenos Ayres, Valparaiso, Manzanillo (Mexico), and home	1883–84
	Carr, H. C.	Superb	1,451	H. Green, Blackwall	To and from Melbourne	1884–85
9	Chaddock, George	Barque Elissa	409	H. F. Watt, Liverpool	Home from Cape Town	1885
10	Clapp, Staff-Comr. E. S., R.N.	Schooner Richmond	183	Board of Trade, London	At the Bahamas	1885–86
	Clarke, James	S.S. Olbers	2,168	Liverpool, Brazil, and River Plate Steam Navigation Co., Liverpool.	Two voyages to Lisbon, Madeira, Bahia, Rio Janeiro, New York, and home	1885
11	" "	" "	"	" " "	Two voyages to Lisbon, Rio Janeiro, New York, and home	1885–86
	Collingwood, John	Barque Asterion	509	R. H. Penney, Brighton	To and from New Zealand	1884–85
	Crowell, S. O.	S.S. Alpha	658	W. Cunard, London	Between Halifax and Jamaica, viâ Bermuda	1885
	" "	"	"	" "	Two voyages between Halifax and Jamaica, viâ Bermuda	1885
12	Crutchley, W. C., R.N.R.	S.S. Kaikoura	2,885	New Zealand Shipping Co., Christchurch, N.Z.	To Cape Town, Wellington, Rio Janeiro, and home	1885
13	" "	"	"	" " "	To Santa Cruz, Cape Town, New Zealand, Rio Janeiro, and home	1885
12	" "	"	"	" " "	To and from New Zealand, viâ Cape	1885–86
	Cummings, Wm.	S.S. Dracona	1,245	W. Thomson, Dundee	To and from Montreal	1885
	Dark, Samuel	Blairgowrie	1,550	G. W. Gray, Glasgow	To Melbourne, Calcutta, and home	1885–86
	Dart, L. C.	Alcester	1,597	R. C. Haws, Liverpool	To Bombay, Rangoon, and home	1884–85
	Davies, Joseph	S.S. Archimedes	966	Liverpool, Brazil, and River Plate Steam Navigation Co., Lim., Liverpool.	To Rio Janeiro, Santos, New York, and home	1885

List of Documents, &c.—*continued.*

	Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
	Davies, Joseph -	S.S. Flaxman - -	1,418	Liverpool, Brazil, and River Plate Steam Navigation Co., Lim., Liverpool.	Two voyages to and from River Plate, &c. - - - - -	1885
	Davison, H. -	S.S. Oceanic - -	2,440	Oceanic Steam Navigation Co., Lim, Liverpool.	From Yokohama to San Francisco -	1884
7	Denham, George -	S.S. Ocean King -	1,606	W. Ross, Glasgow - -	Three voyages to and from Quebec -	1885
	Deuchars, William -	S.S. Jan Mayen -	469	The Dundee Polar Fishing Co., Dundee.	To St. John's, Greenland, and home -	1885
	Donaldson, James -	Gareloch - -	1,177	P. Rintoul, Glasgow - -	To Melbourne, Port Pirie, and home -	1884–85
	Donaldson, R. A. -	S.S. Glenavon -	2,985	J. McGregor, London - -	To China, Japan, New York, viâ Suez, and home - - - -	1885
14	" " -	" - -	"	" " - -	To and from China, viâ Suez - -	1885–86
	Dunbar, J. I. -	S.S. Arracan - -	1,856	British and Burmese Steam Navigation Co., Glasgow.	To and from Rangoon, viâ Suez -	1885
15	" " - Dunn, James -	" - Lord Wolseley -	" 2,518	" " " - Irish Shipowners Co., Lim., Belfast.	" " " - One voyage to and from Philadelphia; one to Philadelphia, Hiogo (Japan), and towards San Francisco -	" 1883–84
	Ellery, William -	Majestic - -	1,884	T. and R. Brocklebank, Liverpool.	To and from Calcutta - - -	1884–85
	England, Thomas -	Barque Jane - -	636	P. Sutherland, Liverpool - -	One voyage to and from Quebec; one to and from Dalhousie - -	1885
	Flinton, Benjamin -	Barque Dartmouth -	915	Merchant Shipping Co., Lim., London.	To Hong-Kong and Havre - -	1884–85
	Fraser, W. D. -	Barque Thomas S. Stowe	686	A. Horsfall, Liverpool - -	To Buenos Ayres, Adelaide, Port Pirie, and home - - - -	1884–85
	Freeman, G. A. -	Barque Hannah and Mary.	380	J. Paul, Lynn - - -	To Demerara, Darien (U.S.A.), and home - - - -	1884–85

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
[16] Freeman, T. W.	S.S. Bellerophon	1,397	Oceanic Steam Navigation Co., Liverpool.	To and from China, viâ Suez	1885
[16] " "	"	"	"	" " "	1885
Fullarton, D.	Timaru	1,306	Shaw, Savill, and Albion Co., Lim., London.	To and from Otago	1885–86
[17] Gay, W.	S.S. Newington	713	R. Mackie, Leith	To and from Algoa Bay, &c.	1885–86
Gordon, James	S.S. City of Agra	2,133	G. Smith, Glasgow	To and from Calcutta, viâ Suez	1886
[7] Graham, W. V.	Barque Bowfell	1,002	R. Brocklebank, Liverpool	To and from Manila	1884–85
Gray, David	S.S. Eclipse	435	D. Gray, Peterhead	To and from Greenland	1885
Grey, Charles, R.N.R.	Mac Millan	1,450	J. McMillan, Jun., Dumbarton	To Calcutta	1884–85
Halley, Edward	City of Madras	1,577	G. Smith, Glasgow	To and from San Francisco	1884–85
Hayward, G. O.	S.S. Dunrobin Castle	1,797	Sir T. Brassey, M.P., Westminster	To and from Natal, &c.	1885–86
Hird, William	Marlborough	1,124	J. Leslie, London	To and from Otago	1884–85
" "	"	"	" "	" "	1885–86
Holdich, J. P., R.N.R.	British Envoy	1,265	J. Coupland, Leicester	To and from San Francisco	1884–85
Horne, James	Loch Sloy	1,225	H. J. Watson, Glasgow	To and from Melbourne	1884–85
[18] Hoskyn, R. F., Commr. R.N.	Myrmidon	877	H.M.S.	Surveying in the Red Sea	1884–85
[19] " "	"	"	"	From Java to Port Darwin, Thursday Island, Townsville (Queensland), and Sydney	1885
Hughes, W. P.	Laomene	1,746	D. Fernie, Liverpool	To and from Rangoon	1884–85
Irving, P. J.	S.S. Republic	2,187	Oceanic Steam Navigation Co., Liverpool.	Five voyages to and from New York	1884–85
" "	"	"	" " "	Six voyages to and from New York	1885–86
Jack, Alexander	Clan Robertson	1,625	T. Dunlop, Glasgow	To and from San Francisco	1884–85
Jameson, John	S.S. India	1,592	T. Henderson, Glasgow	To Mediterranean Ports, New York, and home	1885
Janes, George	Middlesex	1,742	G. Marshall, London	To Sydney, Chittagong, and home	1885–86

LIST of DOCUMENTS, &c.—*continued.*

	Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
	Jeffery, A. W., F.R. Met. Soc.	S.S. Teniers			Two voyages from Antwerp to River Plate and back	
	Johnson, Daniel	Barque Dumfriesshire	1,221	J. Goffey, Liverpool	To Sydney, and home from San Francisco	1884–85
	Jones, Richard	Thomas Hilyard	1,500	D. V. Roberts, St. John, N.B.	To Simon's Town and South Pass, U.S.A.	1885
20	Kellett, Arthur	S.S. Calabria	2,031	Telegraphic Construction and Maintenance Co., London.	To and from Suakim, viâ Suez	1885
21	Kennedy, C. W.	S.S. Germanic	3,150	Oceanic Steam Navigation Co., Liverpool.	Six voyages to, and five from New York	1885
	King, J. W.	Philomene	1,428	D. Fernie, Liverpool	To Calcutta and New York	1884–85
	Lailey, W. N.	S.S. Boyne	1,806	Mercantile S. S. Co., Lim., London.	One voyage to and from Port Said; one to Point de Galle, Akyab, and back to Malta, viâ Suez	1884–85
	„	„	„	„ „ „	From Malta to Liverpool. To Port Said, Odessa, and Amsterdam. Two voyages to and from Alexandria	1885
	Lassesen, Peter	Barque Colin Archer			To Algoa Bay, Alleppy (Malabar Coast), and Oran (Algeria)	1884–85
	Lewis, B. C.	British Merchant	1,696	British Shipowners Co., Lim., London.	From Simon's Bay to Calcutta, and home	1885–86
	Livermore, A. P.	Barque Kingdom of Saxony.	538	J. R. Anderson, London	From lat. 35° S., long. 108° E., to Freemantle, Rangoon, Valparaiso, &c., and towards home to lat. 54° S., long. 77° W.	1884–85
	Livingstone, Alexander.	Mount Carmel	1,596	W. Service, Glasgow	To Sydney, Newcastle (N.S.W.), Bassein, and home	1884–85
22	Lloyd, R. S.	S.S. Buccaneer	460	C. J. D. Christie, Newcastle-on-Tyne.	To West Coast of Africa, and cable laying off the Coast	1885

List of Documents, &c.—*continued.*

	Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
23	Lowe, James -	Barque Agnes Muir -	851	J. Killick, London - -	To Yokohama, Swatow, Hong-Kong, Manila, and home - - -	1883–85
24	Lugar, W. R. -	S.S. Mackay-Bennett -	1,013	J. De Castro, London - -	To Halifax, and lying in harbour -	1885
24	" " -	" " -	"	" " - -	In Halifax Harbour and North Atlantic, then to St. John's, and home -	1885
25	Lunham, R. D. -	S.S. Ceylon - -	2,149	J. L. Clark, London - -	To Madeira, West Indies, New Orleans, Havana, Azores, and home; two voyages to and from Trondjeim; two voyages round coast of British Isles -	1885
25	" " -	" - -	"	" " - -	Round coast of British Islands - -	1885
	McDougall, A. -	S.S. Chittagong -	1,241	Indian S.S. Co., Lim., Glasgow -	To and from Suakim, viâ Suez -	1885
	McGonnell, James -	Barque Forest Queen -	549	S. Lowther, Belfast - -	To and from Miramichi - -	1885
	McLean, Archibald -	S.S. Titania - -	1,406	J. Donaldson, Glasgow - -	Five voyages to and from Montreal -	1885
27	Maclear, J. F. L. P., R.N.	Flying Fish - -	940	H.M.S. - - - -	At Hong-Kong and Manila - -	1884–85
26	" " -	" - -	"	" - - - -	Surveying in China Sea, and thence to Arros Islands - - -	1885
	McMillan, John -	Canterbury - -	1,245	Shaw, Savill, and Albion Co., Lim., London.	To and from Lyttelton - -	1884–85
29	Manning, Henry -	S.S. Seine - -	3,579	Telegraph Construction and Maintenance Co., Lim., London.	To Perim, Zanzibar, Mozambique, and home, viâ Suez - - -	1885
	Maxwell, Joseph -	Oamaru - -	1,306	Shaw, Savill, and Albion Co., Lim., London.	To and from Wellington - -	1884–85
	Meredith, John -	Brigantine Meg Merrilies.	—	- - - - -	From Fiji to the New Hebrides, Solomon Islands, and back - -	1884–85
	" " -	" - -	—	- - - - -	Two voyages from Fiji to the New Hebrides, and back.	1885
	Mesnard, Thomas -	Sierra Miranda -	1,808	A. M. Anderson, Liverpool -	To Madras, Rangoon, and home -	1885

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
Metcalfe, J. - -	S.S. Oceanic - -	2,440	Oceanic Steam Navigation Co., Lim., Liverpool.	Between San Francisco and Hong-Kong, viâ Yokohama - -	1884-85
[30] Miller, A. T., R.N. -	Conway - -	—	Training Ship - - -	Off Birkenhead - - -	1885
[31] Milne, W. F. -	S.S. Esquimaux -	466	Dundee Whale and Seal Fishing Co., Dundee.	To St. John's, Davis Straits, and home	1885
Mitchell, George -	S.S. Trinacria -	1,466	T. Henderson, Glasgow - -	One voyage to Mediterranean ports, New York, and home; one voyage to Malaga - - - -	1885
Moffatt, H. Y. -	S.S. City of Venice -	2,092	G. Smith, Glasgow - -	In the Red Sea - - -	1885
Moignard, Ph. -	Barque Allonby -	1,400	P. Iredale, Liverpool - -	To Sydney, San Francisco, and home -	1884–85
Molony, E. J. -	British Merchant -	1,696	British Shipowners Co., Lim., London.	To Melbourne, Newcastle (N.S.W.), San Francisco, Newcastle (N.S.W.), Wilmington, San Francisco, and Havre - - -	1883–85
,, ,, -	,, ,, -	,,	,, ,, ,, ,, -	To Simon's Bay - - -	1885
Moodie, G. - -	S.S. State of Georgia -	1,507	The State S.S. Co., Lim., Glasgow	Seven voyages to and from New York -	1884–85
[32] Moore, W. U., R.N.	Dart - - -	470	H.M.S. - - - -	From Sydney to Fiji, Gilbert Islands, Marshall Islands, and back to Sydney	1884
,, ,, -	,, - - -	,,	,, - - - -	At Australian station - - -	1884–85
[33] ,, ,, -	Rambler - -	835	,, - - - -	Surveying in China Sea - -	1885
Murdoch, Peter -	Sierra Estrella -	1,436	A. M. Anderson, Liverpool -	To Bombay, Rangoon, and home -	1885
New, George -	S.S. Annie - -	1,247	J. Gray, Whitby - - -	Two voyages to and from Baltimore -	1885
[34] Nicholson, Malcolm -	St. Vincent - -	891	T. L. Devitt, London - -	To and from Adelaide - - -	1885–86
Norman, F. -	Barque Polestar -	625	J. Lyne, Liverpool - -	To and from Callao, &c. - -	1884–85

LIST OF DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
Parry, Moses -	S.S. Prydain - -	1,252	Prydain S.S. Co., Lim., Nevin -	One voyage to and from Odessa; one to and from New York; one to Genoa, and New York - -	1884–85
" -	" - -	"	" " " " -	From Palermo to New York, Leith, Trieste, Marseilles, New York, Copenhagen, Helsingfors, and home.	1885
[35] Parsell, Henry -	S.S. Adriatic - -	2,458	Oceanic Steam Navigation Co., Liverpool.	Five voyages from and to New York -	1885
" " -	" - -	"	" " " " -	Six voyages from, and five to, New York - - - -	1885
Parson, G. F. -	Earnock - -	1,198	W. Fraser, London - -	To and from Launceston, Tasmania -	1884–85
[36] Pearson, C. W. -	S.S. Strathleven -	2,436	W. Burrell, Glasgow - -	From New York to China and Japan, viâ Suez - - - -	1885
[36] " " -	" -	"	" " - -	From Hong-Kong to Yokohama, Shanghai, New York, viâ Suez, and Gibraltar	1885–86
Peebles, Robert -	Barque Tweedsdale -	1,403	J. Roxburgh, Glasgow - -	To Melbourne, Java, and home -	1885
Plater, H. R. F. -	Patriarch - -	1,339	W. Henderson, Aberdeen -	To and from Sydney - - -	1885–86
Pomeroy, Herbert -	Barque Elissa - -	409	H. F. Watt, Wavertree, Liverpool.	To and from Galveston - -	1883–84
[37] Potter, Thomas -	S.S. Durham - -	1,466	W. S. Bailey, Hull - -	Trading to and from Mediterranean Ports - - - -	1885
[38] Powles, F. W. -	S.S. Essequibo -	1,341	R. Mail Steam Packet Co., London.	To and from West Indies - -	1885–86
Prout, J. C. -	Cape St. Vincent -	1,422	A. P. Lyle, Greenock - -	To and from Java - - -	1884–85
Quaile, D. W. A. -	Orissa - - -	1,199	R. Kerr, Greenock - -	To and from Java - - -	1884–85
Randall, W. -	Dynomene - -	1,900	D. Fornie, Liverpool - -	From New York to Bombay, Calcutta, and home - - - -	1884–85

LIST of DOCUMENTS &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
[89] Reed, W. J.	The Hahnemann	1,937	The Hahnemann Ship Co., Liverpool.	To Singapore, Calcutta, and towards home to lat. 20° N., long. 36° W.	1884–85
Renaut, C. H.	Pleione	1,092	The Shaw, Savill, and Albion Co., Lim., London.	To and from Wellington (N.Z.)	1884–85
Rosseter, W. L.	Barque St. Kilda	865	A. T. Parker, Liverpool	To and from Demerara	1885
" "	" "	"	" "	" "	1885–86
Russell, C. J.	Candahar	1,418	R. Brocklebank, Liverpool	To and from Calcutta	1884–85
Sangster, William	S.S. Dracona	1,245	W. Thomson, Dundee	One voyage to and from Montreal, one to Genoa, Halifax (N.S.), and home; one to Ceylon, viâ Suez	1884–85
" "	"	"	" "	One voyage home from Ceylon, viâ Suez; one to and from Montreal	1885
" "	"	"	" "	One voyage to and from Montreal; one to and from Kurrachee, viâ Suez	1885–86
Sargent, A. H.	Barque Glenlora	774	Shaw, Savill, and Albion Co., Lim., London.	To and from Auckland	1884–85
[10] Savage, W. M., R.N.	Schooner Richmond	183	Board of Trade, London	At the Bahamas	1885
[10] " "	" "	"	" "	" "	1885
Scott, George	Iolanthe	1,593	J. F. Cruickshank, Liverpool	From New York to Shanghai	1884–85
" "	"	"	" "	From lat. 0°·45 N., long. 105° E., to Shanghai, Manila, and San Francisco	1885
Scott, William	Barque Commewyne	315	J. Grierson, Glasgow	To Surinam, Barbados, and home	1885
Shaw, Gilbert	S.S. Beta	1,087	W. Cunard, London	Between Halifax and Jamaica, viâ Bermuda	1885
" "	"	"	" "	Four voyages between Halifax and Jamaica, viâ Bermuda	1885–86
Sheldrake, J. W.	Iron Cross	1,508	D. Fernie, Liverpool	To Calcutta, New York, and home	1884–85

List of Documents, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
Simpson, Alexander	S.S. Australasian	2,343	W. Henderson, Aberdeen	To Cape Town, Adelaide, Sydney, Suakim, Bombay, and home viâ Suez	1884–85
„ „	„	„	„ „	To and from Hobart, viâ Cape Town	1885
„ „	Schooner Traveller	196	A. Simpson, Peterhead	From Copenhagen to Ivigtut, Copenhagen, Dantzic, Dunkirk, and Peterhead	1885
Sinclair, J.	Barque City of Tanjore	768	T. C. Guthrie, Glasgow	From lat. 39° S., long. 5° E., to Mauritius	1884
[30] Smith, J. H., R.N.R.	Worcester	—	Training Ship	Off Greenhithe	1884–85
Spratly, W.	S.S. Mozart	1,304	Liverpool, Brazil, and River Plate Steam Nav. Co., Liverpool.	One voyage to and from Monte Video; one to Rio Janeiro, New York, and home	1885
Stealey, John	Barque Emily Waters	446	G. S. Richardson, Swansea	To and from Valparaiso	1885
Stewart, J. R.	S.S. Ayrshire	871	J. Turnbull, Glasgow	To Aspinwall, New Orleans, Lisbon, and home	1884–85
Sturdee, H. K.	Schooner Richmond	183	Board of Trade, London	At the Bahamas	1885
„ „	„ „	„	„ „	„ „	1885
[7] Thomson, A. S.	S.S. Dacia	1,473	The India Rubber, Gutta Percha, and Tel. Works Co., London.	To and from Cay West, Florida, U.S.A	1885
Thompson, R. D.	Cosmo	1,220	J. G. Ross, Quebec	To Callao, Newcastle (N.S.W.), Manila, and Sandy Hook	1883–85
[40] Tindall, W. A.	S.S. International	1,004	„ „ „	To and from Suakim, viâ Suez, and observations at Suakim	1885
[41] Tomlin, P. S.	S.S. Ballaarat	4,752	P. & O. Steam Navigation Co., London.	To and from Melbourne, viâ Suez	1885
Trant, W. H.	S S. Venetian	2,733	S.S. Venetian Co., Liverpool	Five voyages to and from Boston	1884–85
„ „	„ „	„	„ „ „	„ „ „	1885–86

List of Documents, &c.—*continued.*

Captain's Name.	Ship	Tons.	Owners.	Voyage.	Year.
[42] Travers, H. de la Cour.	S.S. Tartar	2,755	Union S.S. Co., Lim., Southampton	To and from Cape Town, &c.	1885
„ „	„	„	„ „ „	Two voyages to and from Cape Town	1885
[43] Trott, Samuel	S.S. Minia	1,350	Anglo-American Telegraph Co., London.	At Halifax, thence to Falmouth and Brest	1885
[43] „ „	„	„	„ „ „	Cable laying in North Atlantic	1885
[43] „ „	„	„	„ „ „	„ „ „	1885–86
Trunks, H.	Barque Aldborough	1,425	British and Eastern Shipping Co., Lim., Liverpool.	To and from San Francisco	1884–85
[33] Vereker, Hon. F. C. P., R.N.	Rambler	835	H.M.S.	To Diego Garcia, viâ Suez	1885
[33] „ „	„	„	„	From Diego Garcia to Singapore and China, and surveying in China Sea	1885
[33] „ „	„	„	„	Surveying in China Sea	1885
Wait, A. McLean, R.N.R.	S.S. Spartan	2,223	Union S.S. Co., Lim., Southampton	Two voyages to and from Cape Town &c.	1884–85
[44] „ „	„	„	„ „ „	„ „ „	1885
Walker, Henry	S.S. Cephalonia	3,490	Cunard S.S. Co., Lim., Liverpool	Five voyages to and from Boston	1885
[45] Ward, John	Pegasus	2,564	T. C. Wilkinson, Liverpool	To and from Calcutta	1884–85
[46] Watson, Alexander	Barque Elvira	464	H. F. Watt, Wavertree, Liverpool	To Monte Video, Mauritius, Rangoon, Chittagong, Barbados, Jamaica, and home	1884–86
[9] Watt, H. F.	Barque Elissa	409	„ „ „	From Rangoon to Cape Town	1885
[47] West, Frederick	S.S. Port Adelaide	1,783	Anglo-Australasian Steam Nav. Co., London.	To and from Australia, viâ Suez	1885–86
[48] Whall, W. B.	S.S. Lapland	823	Sir T. Brassey, M.P., Westminster	Trading between Liverpool and Hamburg	1885

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
Wheaton, N. J. -	Barquentine Eliza -	299	J. H. Goodyear, Liverpool -	To Rio Grand do Sul, Pernambuco, Barbadoes, Guadeloupe, Nantes, and home. One voyage also to and from Madeira - - - -	1884–85
" " -	" " -	"	" " -	To and from Demerara - -	1885–86
White, J. - -	Barque Guyana -	593	A. Crum Ewing, Glasgow -	To and from Mauritius - -	1884–85
Wilson, John -	S.S. Ethiopia - -	2,604	Barrow S.S. Co. Lim., Barrow -	Five voyages to and from New York -	1884–85
" " -	" " - -	"	" " " -	" " " " -	1885
Wilson, William -	Barque Horsa - -	1,128	Star Nav. Co., Liverpool " -	To and from Java - - -	1884–85
Youlden, H. -	Barque May Hulse -	463	J. Ransom, Southampton -	To Buenos Ayres, Pisagua, and home - - - - -	1884–85

In cases distinguished by marginal numbers the Meteorological Registers were kept chiefly by Officers, as follows:—

Kept by H. M. Lambert, R.N.R., 2nd Officer.
2 **Kept** by Alfred Baker and G. Philipps, 4th Officers.
3 **Kept** by G. Philipps, 4th Officer.
4 **Kept** by Walter Folgate, R.M.L.I., under the direction of Lieut. A. Havergal, R.N.
5 **Assisted** by Messrs. Morton, Broom, and Poland.
6 **Kept** by E. J. Evans, 2nd Officer.
7 **Assisted** by Officers.
8 **Kept** by Thomas Stewart, 3rd Officer.
9 **Kept** by G. Macpherson and T. Calver.
10 **Kept** by H. King Sturdee.
11 **Kept** by R. W. Trennaman, 2nd Mate.
12 **Kept** by H. J. Blanchard, 4th Officer.
13 **Kept** by H. W. Bennett, 4th Officer.
14 **Kept** by Officers.
15 **Kept** by Henry Hayes, 3rd Officer.
16 **Kept** by Robert Inkster.
17 **Kept** by Capt. George Scott, Passenger.
18 **Kept** by Lieutenant James East, R.N., and Sub-Lieutenant Gerald A. Heyman, R.N.
19 **Kept by Lieutenant Gerald A. Heyman, R.N**
20 Kept by A. J. Page, 2nd Officer.
21 Kept by C. Lancaster.
22 Kept by G. H. Little, Chief Officer.
23 Assisted by F. Elburn, 2nd Officer.
24 Kept by John Bevan, Navigating Officer.
25 Kept by Messrs. Tremble and Kearns.
26 Kept by W. J. Black, M.D., Surgeon-Major.
27 Kept by Lieutenant W. Van Sittart Howard, **R.N.**, and Sub-Lieutenant W. O. Lyne, R.N.
28 Kept by Sub-Lieutenant W. O. Lyne, R.N.
29 Kept by W. W. Inglis, 2nd Officer.
30 Kept by the Boys.
31 Kept by G. G. Tyson, Surgeon.
32 Kept by Lieutenant C. de la Poer Beresford, **R.N.**, assisted by Quartermasters.
33 Kept by Lieutenant Andrew Balfour, R.N.
34 Assisted by Chief Officer.
35 Kept by Robert Ward, 3rd Officer.
36 Assisted by A. S. Robertson, 2nd Officer.
37 Assisted by W. H. Ross, 2nd Officer.
38 Kept by W. H. Bennett Trigg, 3rd Officer.
39 Assisted by Mr. Kendrick, 2nd Officer.
40 Kept by D. Wilson Barker, F.R.Met. Soc., Chief Officer, assisted by S. C. Poland, 3rd Officer.
41 Kept by S. de B. Lockyer, 2nd Officer.
42 Kept by G. C. Gordon, 2nd Officer.
43 Kept by Richard Ladd, F.R.A.S., F.R.Met.Soc.
44 Kept by G. F. Weedon, 4th Officer.
45 Assisted by E. Morris, 3rd Mate.
46 Kept by Frank Edge, 1st Officer, and T. G. Partington, 3rd Officer.
47 Kept by D. E. Jamieson, 2nd Officer, and W. H. Guy, 3rd Officer.
48 Assisted by J. Ross, 1st Officer.

APPENDIX III.

INSTRUMENTS supplied, &c. to the Royal Navy.

Per Account.	Barometers.	Aneroids.	Thermometers.				Hydrometers.
			Ordinary.	Max.	Min.	Screens.	
April 1st, 1885, afloat	184	377	1,097	164	135	108	126
Issued since	66	123	363	73	64	28	88
	250	500	1,460	237	199	136	214
Returned since	59	103	245	34	36	17	80
April 1st, 1886, afloat	191	397	1,215	203	163	119	134

INSTRUMENTS supplied, &c. for use at Naval Stations.

April 1st, 1885, in use	74	113	255	21	33	5	16
Issued since	8	5	42	4	3	2	4
	82	118	297	25	36	7	20
Returned since	3	8	38	7	6	—	—
April 1st, 1886, in use	79	110	259	18	30	7	20

DISPOSITION of ADMIRALTY INSTRUMENTS on April 1st, 1886.

Afloat in Royal Navy	191	397	1,215	203	163	119	134
In use at stations	79	110	259	18	30	7	20
In store at M.O.	71	54	107	40	72	8	44
„ Chatham	7	7	4	5	5	6	4
„ Sheerness	4	7	26	5	4	3	9
„ Portsmouth	6	7	10	12	13	6	8
„ Devonport	5	4	12	9	15	1	28
„ Queenstown	3	3	1	1	1	—	8
„ Gibraltar	1	4	2	—	—	—	4
„ Malta	5	11	11	2	4	—	18
„ Halifax	5	10	28	5	6	—	14
„ Bermuda	6	10	34	2	4	—	15
„ Jamaica	3	2	12	2	2	—	—
„ Cape of Good Hope	5	10	47	8	9	3	31
„ Trincomalee	2	3	21	3	3	—	—
„ Hong Kong	18	13	51	4	4	2	9
„ Coquimbo	1	6	24	3	2	—	19
„ Sydney	6	5	32	5	5	—	—
„ Esquimalt	6	4	10	2	2	—	—
Total, April 1st, 1886	419	667	1,906	329	344	155	365
Lost, &c. since April 1st, 1885	—	7	139	9	—	8	6
Under repair	8	—	—	—	—	—	—

APPENDIX IV.

Instruments supplied, &c. to Mercantile Marine.

Per Account.	Barometers.	Compasses.	Thermometers.				Hydrometers.
			Ordinary.	Max.	Min.	Screens.	
April 1st, 1885, afloat - -	139	—	768	—	1	144	453
Issued since - - -	107	—	631	1	—	101	274
	246	—	1,399	1	1	245	727
Returned since - -	107	—	625	—	—	103	324
April 1st, 1886, afloat - -	139	—	774	1	1	142	403

Instruments at Stations, viz., Telegraph Offices, Observatories, Navigation Schools, &c.

April 1st, 1885, in use - -	113	4	261	64	61	36	41
Issued since - - -	14	—	36	5	2	2	—
	127	4	297	69	63	38	41
Returned since - -	13	—	14	3	2	—	16
April 1st, 1886, in use - -	114	4	283	66	61	38	25

Disposition of Board of Trade Instruments on April 1st, 1886.

In merchant ships - -	139	—	774	1	1	142	403
In use at stations - -	114	4	283	66	61	38	25
In store at M.O. - -	15	1	98	1	36	65	80
At Liverpool Agency -	9	7	47	—	—	14	20
„ Aberdeen „ -	5	—	33	—	—	3	21
„ Glasgow „ -	7	—	30	—	—	6	18
„ Dundee „ -	11	—	44	—	—	12	36
„ Hull „ -	5	—	27	—	—	8	20
„ Southampton „ -	6	—	28	—	—	8	25
„ Cardiff „ -	2	—	13	—	—	4	14
Total, April 1st, 1886 -	313	12	1,377	68	98	300	662
Lost, &c. since April 1st, 1885	—	—	144	—	—	19	62

APPENDIX V.

List of Stations reporting Meteorological Observations by Telegraph to the Office on 31st March 1856, with the Names of Observers.

*†Sumburgh Head -	Rev. W. Brand - - -	Minister of Dunrossness.
*†Stornoway - -	D. MacDonald - - -	Late Officer S.S. "Great Eastern."
Wick - -	J. Sinclair - - - -	Watchmaker.
Nairn - - -	Miss Penny - - - -	Schoolmistress.§
*†Aberdeen - -	J. McCormack - - -	Telegraph Clerk.
Leith - - -	W. Hay - - - -	Do.
*†Shields - -	J. W. Irvine - - - -	Do.
Spurn Head -	J. B. Smith - - - -	Assistant Lightkeeper.
†York - - -	H. M. Platnauer, F.G.S. - -	Curator of Museum.
Loughboro' - -	W. Berridge, F.R.Met.Soc. -	
†Ardrossan - -	J. W. Mayes - - - -	Telegraph Clerk.
Malin Head - -	P. O'D. Farren - - -	Signalman, Lloyd's.
*†Mullaghmore -	K. Kerr - - - -	Retired Coastguard Officer.
*†Belmullet - -	Miss M. J. Tolan - - -	Telegraphist.
Donaghadee - -	T. MacGowan - - -	Telegraph Clerk.
Parsonstown - -	B. Budds - - - -	Assistant Observer at Lord Rosse's Observatory.
Barrow-in-Furness -	W. S. Whitworth - - -	Engineer, Barrow-in-Furness Railway.
*†Holyhead - -	Capt. Richards - - -	Keeper of Sailors' Home.
Liverpool - -	J. Hartnup, F.R.Met.Soc. -	Bidston Observatory.
*†Valencia - -	J. E. Cullum - - -	Superintendent of the Observatory.
Roche's Point - -	W. Kennedy - - - -	Telegraph Clerk.
Pembroke - -	Messrs. Blake and Spicer -	Lightkeepers.
*†Scilly - - -	W. Thomas - - - -	Signalman.
Prawle Point - -	J. John - - - -	Coastguard Officer.
†Hurst Castle - -	G. G. Appleton - - -	Lightkeeper.
†Jersey - - -	J. Fisher - - - -	Signalman.
*†Dungeness - -	P. Curnow - - - -	Lightkeeper.
*†London - -	F. Gaster, F.R.Met.Soc - -	Clerk, Meteorological Office.
Oxford - - -	W. Wickham - - - -	Radcliffe Observatory.
Cambridge - -	H. Todd - - - -	Observatory.
*†Yarmouth - -	G. T. Watson - - -	Secretary, Sailors' Home.
‡Hawes Junction -	W. H. Bunce - - - -	Station Master.

Note.—Those stations marked with an asterisk (*) report also at 2h. p.m.; and those with a dagger (†) at 6h. p.m.

‡ This station now reports by post only.

§ Mr. Penny died in 1885.

APPENDIX VI.

Report of the Inspection of the Irish and Welsh Stations.

I have the honour to report that I have completed the inspection of the Irish and Welsh stations, with the following exceptions:—*Telegraphic stations*—Roche's Point, Donaghadee, and Malin Head (the last visited by Captain Toynbee in July). *Stations of the Second Order*—St. David's, Armagh, and Londonderry (Captain Toynbee), and *Weekly Weather Report Station* Foynes; the last-named being omitted owing to inconvenience in the train arrangements.

Telegraphic Stations.

St. Ann's Head, September 30.—The only point calling for remark is the appointment of a new observer, J. F. Spicer, in place of Baker, promoted to another lighthouse.

Parsonstown, October 2.—Here also there is a new assistant observer, W. Harding, junior. A slight change was required here, the sunshine recorder being somewhat shaded on summer evenings by a tree. It was removed by me a few feet southwards.

Valencia, October 7.—The station was as usual in good order. Some details as to the observatory will be found below.

Mullaghmore, October 12.—The instruments here have been removed to a fresh site. The exposure does not differ appreciably from that previously existing. The thermometer screen and rain-gauge are erected in a small enclosure surrounded by a stone wall 3 feet high.

Belmullet, October 14.—I find this station in a much better condition than previously. The wind reports are, however, not quite satisfactory as yet. The vane has been supplied, but has not yet been erected, as the telegraph workmen have not been in the town lately.

Holyhead, October 19.—The new observer, Captain Richards, seems very capable. The instruments are in good order.

Stations of the Second Order.

Parsonstown, October 2.—See above.

Dublin, Fitzwilliam Square, October 9.—The rain-gauge and thermometers have been placed on a mound 5 feet high, which raises them nearly on a level with the top of the garden wall.

Dublin, Glasnevin, October 9.—The station is in good order. It is proposed to move the thermometers, &c. a little further from the conservatory. They are very conspicuous, and are much interfered with by visitors, three grass minimum thermometers having been stolen or broken.

Dublin, Mountjoy, October 9.—The only matter calling for remark is that I discovered that the sunshine recorder was not level. This was suspected by the observer, but the fact had not been proved. The defect has existed for the last two years, and has affected the indications close to the summer solstice. It is now corrected.

Colebrooke, October 10.—The question about the level of this station has apparently been set at rest by the running of a set of levels from the Ordnance B.M. to the site. The level shown on the map is apparently 31 feet too low.

Markree, October 13.—This station calls for no remark. Mr. Marth has at last succeeded in finding an assistant observer, whom he is training.

Weekly Weather Report Stations.

Llandovery, September 29.—The thermometers have now been removed to the garden, and erected in a screen, which only requires a slight change to be satisfactory. This will be carried out.

Waterford, October 1.—The station calls for no remark.

Kilkenny Castle, October 1.—The thermometer screens and rain-gauge have been moved to the lawn, and are well exposed, excepting that they are rather near trees on the north.

Killarney, October 6.—This station is considered to give exceptionally low minimum readings. I believe that this arises from its being situated near the foot of a slope, down which the cold air descends.

Currygrane, Edgeworthstown.—This is a new station. Mr. J. M. Wilson has organised it. The thermometers are in a Stevenson screen, fairly well exposed on a lawn. There are no trees very close, and none to the southward.

Observatory.

Valencia, October 7.—At this observatory I find, as usual, some repairs wanting. The stove for distilling water is out of order, and requires to be reset. The sea wall has also suffered from storms and requires repair. I have directed Mr. Cullum to send in estimates for both of these works.

October 21, 1885. (Signed) Robert H. Scott.

The following table shows the results of thermometric comparisons:—

Stations.	Dry Bulb.	Wet Bulb.	Max.	Min.	Spare Therm.	Remarks.
Stations of the Second Order.						
Birr Castle	−0·3	0·0	−0·3	−0·1	—	
Colebrooke	−0·6	−0·4	−0·4	−0·1	—	
Dublin (City)	−0·5	−0·5	−0·8	+0·2	−0·3	Grass min. not graduated on stem.
Dublin (Phœnix Park O.S.O.)	−0·3	−0·5	−0·3	+0·1	—	Grass min. −0·07.
Glasnevin	0·0	−0·3	−0·3	+1·1	—	Grass min. +1·9.
Markree Castle	0·0	+0·1	+0·1	+0·6	—	New instrument by Yeates.
Telegraphic Reporting Stations.						
Mullaghmore	+0·1	+0·3	+0·4	+0·2	—	Instruments shifted since last inspection.
Belmullet	+0·2	+0·3	0·0	+0·2	—	
Parsonstown	+0·3	0·0	+0·2	+0·1	—	
Valencia	+0·2	+0·2	+0·1	−0·7	+0·4	Spirit in min. found detached.
St. Ann's Head	+0·3	+0·3	−0·3	+0·3	+0·3	
Holyhead	+0·6	+0·3	+0·3	+0·5	−0·3	Spare ther. substituted for dry bulb.
Weekly Weather Report Stations.						
Edgeworthstown	+0·6	+0·7	+0·8	+0·1	−0·3*	*Grass min. ther.
Waterford	+0·2	+0·2	+0·6	−0·4	−1·4*	* Do. do.
Kilkenny	+0·5	0·0	−0·3	0·0	—	Screen shifted since last inspection.
Killarney	+0·5	+0·6	+0·4	+0·3	—	

Sir, Port Stewart, June 26, 1885.

I have the honour to report, for the information of the Meteorological Council, that on June 22nd I inspected Mr. Conroy's station, at No. 40, Clooney Terrace, Londonderry. The station was in very good order.

On June 23 I proceeded to Malin Head, where I found Mr. P. O'D. Farren (who is Lloyd's signalman) in charge of the station. His brother, Mr. J. O'D. Farren (who is Lloyd's agent), acts for him when occasion requires.

I remain, &c.
(Signed) HENRY TOYNBEE,
Marine Superintendent.

R. H. Scott, Esq.,
Meteorological Office,
116, Victoria Street, London, S.W.

REPORT of INSPECTION of the SCOTTISH STATIONS for 1885.

BAROMETERS.

The barometers at the stations were compared with inspector's mercurial standard barometer No. 588. The results are shown in the following table, which gives the corrected readings of standard No. 588, and the uncorrected readings of the reporting and check barometers at each of the stations. It thus appears that each of the instruments continue to be in excellent order:—

STATIONS.	Inspector's Standard No. 588, corrected.	Reporting Barometer, not corrected.	Check Barometer, not corrected.	REMARKS.
	Inches.	Inches.	Inches.	
Laudale	29·843	29·845	29·835	Check barometer is 8 feet higher Reduced to same temperature.
Stornoway	30·189	30·188	30·190	
Sandwick	30·158	30·169	—	
Dunrossness	29·868	29·866	29·866	
Wick	30·222	30·224	—	In shop.
Do.	30·144	—	30·144	In house.
Dunrobin	30·251	30·252	—	
Inverness	30·162	30·160	—	
Nairn	30·031	30·031	30·032	
Aberdeen	29·783	—	29·785	In house, Braemar Place.
Do.	29·787	29·787	—	In post office.
Braemar	28·405	28·414	—	
Dundee	28·883	28·880	—	
Glenalmond	28·811	28·806	—	Reduced to same temperature.
Pinmore	29·865	29·866	—	
Ardrossan	30·040	30·037	—	In post office.
Do.	30·024	—	30·023	In house at Saltcoats.
Rothesay	30·078	30·080	—	
Leith	29·973	29·960	—	In post office.
Do.	29·942	—	29·935	In house, 52, Great Junction Street.
King's College, Aberdeen	29·695	29·696	—	

The difference between the inspector's and observer's readings was generally nil, and, excepting in two cases, did not exceed 0·002 inch.

The assistant at Stornoway read 0·005 inch, and the assistant at Wick 0·004 inch too low, owing to their method of setting the vernier. After being shown the proper method they read correctly.

Thermometers.

The results of comparisons made with inspector's standard thermometer No. 2,522, and the thermometers at the different stations, and at Aberdeen Observatory, are given in the following table, the readings of the standard have been corrected for instrumental errors, but the thermometers at the stations are uncorrected:—

Stations.	Standard No. 2,522, Corrected.	Dry Bulb.	Wet Bulb.	Spare Thermometer.	Maximum Thermometer.	Minimum Thermometer.	Time in Water in Minutes.	Change of Temperature of Water.	Notes.
	°	°	°	°	°	°		°	
Laudale -	60·1	+0·1	+0·1	—	+0·2	+0·2	90	Uniform	
Stornoway -	52·3	+0·6	+0·5	+0·3	−0·4	−0·5	100	Do.	
Sandwick -	52·7	+0·3	0·0	—	+0·5	−0·5	90	+0·3	
Dunrossness	60·5	+0·3	+0·3	+0·2	+0·2	−0·7	100	+0·3	
Wick - -	56·9	+0·3	+0·4	—	−0·3	0·0	80	−0·2	
Dunrobin -	56·1	−0·4	−0·6	—	+0·5	−0·6	105	+0·2	
Inverness -	53·8	—	—	—	0·0	+0·1	100	Uniform	New hygrometer not yet got.
Nairn -	52·9	+0·6	+0·7	+0·2	−0·2	+1·0	70	Do.	
Aberdeen -	60·7	+0·3	+0·4	—	+0·6	+0·1	90	−0·2	
Braemar -	51·3	+0·5	+0·5	—	+0·6	0·0	95	+0·3	
Dundee -	50·2	+0·4	+0·5	—	+1·3	−0·3	80	+0·4	
Glenalmond	48·6	+0·1	+0·2	—	+0·2	−0·2	120	Uniform	
Pinmore -	44·8	+0·2	+0·3	—	−0·2	−0·3	75	+0·5	
Ardrossan -	48·1	+0·3	+0·4	—	0·0	−0·3	105	Uniform	
Rothesay -	47·3	−0·1	−0·1	—	0·0	−0·4	120	Do.	
Leith - -	48·0	+0·1	+0·5	—	0·0	−0·3	70	+0·2	

Notes on the Stations.

Laudale, August 7.—The observations appear to continue to be carefully made. The discrepancies in the barometric readings of March 8 and 20 were examined, and the liability to make errors of observations of one-tenth and half-tenth inch was explained. Attention will be more fully given in future to avoid these errors. It is satisfactory to report that during the extensive alterations in the building made last year, neither of the two barometers sustained any damage in the removals which took place.

Stornoway, August 14.—The instruments were well observed by Mr. M'Donald, and in very good order, except the rain-gauge which was slightly elliptical, but which was put right.

Annabella M'Donald, the assistant, on my first visit on Thursday read the barometer 0·005 inch too low, and had great difficulty in making up the telegram from the observations, but on Saturday she read all the instruments correctly and expeditiously, and made up the telegram with despatch and accuracy. As regards the winds at this station, the observer is of opinion that South-east winds tend to draw more to Southward, and North winds to Westward. The reported rarity of Northerly gales from Stornoway may be explained, at least in part, by the physical configuration of the ground towards the North.

The barograph was fully explained and set agoing, and to secure the firm support required, a little shelf is to be made for it on the wall.

Sandwick, August 19.—The instruments were in the same positions they had when under the late Dr. Clouston's care, and Mr. and Mrs. Anderson made the observations fairly well. The sunshine recorder was very slightly out of position, but was put right and its proper position shown. The Rev. Mr. Anderson, who had been appointed observer here, intimated his resolution to cease being observer, as his duties as clergyman left him no time to attend to the observations.

Dunrossness, August 22.—The instruments were in good order and correctly observed. Though thunder occurred three or four times and hail two or three times during the year, they are not in the observation book. No aurora was observed; it is, however, probable that the hill to north of the Manse prevents many auroræ being seen. A note with directions as to the notes of weather which it is necessary to make and enter in his diary, was left with the observer. During my visits to this station, the estimations of wind force have been correctly given. All instances of wind force 7 and upwards recorded since inspection of August 1884 were extracted. These have since been compared with the wind observations at the lighthouses at Sumburgh Head and Bressay with the result that the general correctness of the Dunrossness observations is confirmed by the lighthouse records. Indeed the only gale recorded at Sumburgh Head, and not noticed in the Dunrossness register, was one of short duration on the nights of November 9–10.

Wick, August 25.—The thermometer screen had been repaired and repainted, and the instruments were all in good order and the observations made very accurately by Mr. Sinclair. His assistant, Jesse Sinclair, read the barometer 0·004 inch too low. The proper method for setting the vernier was explained, after which she read the barometer correctly.

Dunrobin, August 26.—A new Stevenson screen has replaced the old one since January 1, which was considered to be the most suitable time to make the change. The rain-gauge, which was slightly deformed, was put right. As the scale of the hygrometer is now rather indistinct a new one is very desirable for this station, and has been recommended.

Inverness, August 27.—A new hygrometer has not yet been obtained for this station, but I was informed it would shortly be had. The observations which were to have been resumed on October 1, 1884, were not resumed till July 23, 1885, and then only for a few days. The thermometer screen was found to be out of repair and at the time of inspection was undergoing repair. No rainfall observations were made during the year. The barometer, maximum and minimum thermometers and rain-gauge were in good order, and the observations were expected to be resumed on September 1.

Nairn, August 29.—The thermometer screen had been repainted and repaired and the rain-gauge removed to the new position referred to in last year's report. The instruments were in good working order. Miss Penny, who, in the absence of her father, was in charge of the station, made the observations and prepared the telegram with despatch and intelligence. A large additional portion of the neighbouring wood has been cut down; and now only a small portion to westward remains to interfere in any material degree with the observations, and this patch is being cut down as required.

Aberdeen, September 7.—The Stevenson screen had been recently repainted and all the instruments were in excellent order and observed with much intelligence. The spare thermometer had recently been accidentally broken,

The barograph had been some weeks at work and Mr. McCormack understood and handled it properly. It has been placed in a good firm position on a shelf on the wall.

Braemar, September 8.—The instruments were all in good order and well observed. A Stevenson screen had been added since October 1, 1884, and a comparison will shortly be made between the observations made in this screen and those in the old thermometer screen of the station.

Dundee, September 30.—The instruments were all in good order and the observations were intelligently made. The hygrometer is very well attended to.

Glenalmond, October 1.—The instruments were in excellent order, and the new observer, Mr. A. S. Reid, M.A., F.G.S., mathematical master in the College, is a careful observer, and takes much interest in the observations. The outside observations are made only at 9 a.m. and the maximum temperature then read is entered for the previous day and the minimum temperature for the day it is read.

Pinmore, October 13.—The hygrometer and other instruments were in very good order, and the observations intelligently made. The observer continues to take a good deal of trouble to observe the direction and force of the wind in positions which give results as little influenced by the valley of the Stinchar as circumstances permit.

Ardrossan, October 14.—The thermometer screen was painted and the rain-gauge firmly fixed shortly after last inspection, and these instruments were in a very satisfactory state. The minimum thermometer had nearly a degree of spirit separated about half-way up the tube. The observer, under direction, set it right. The cloth of the wet bulb was rather dirty, probably from the soot and dust of the railway, from which towards the station an easterly wind with mist had been blowing for some time. Otherwise the instruments were in fairly good order, the readings on opening the screen being dry bulb 50°·2 and wet 46°·9. The cloth had been changed 10 days previously. For the future the observer was directed to change the cloth at least once a week, proximity to the railway rendering a frequent change of the muslin necessary. The observer and assistant made the observations carefully and intelligently. The code for cirrus cloud observations, and methods for making the observations and preparing the cirrus telegram were gone over in detail, and reports of cirrus cloud will commence forthwith to be sent.

Rothesay, October 14.—The instruments were in good order, and the observations made with much intelligence. At the end of the year a new pole 50 feet in height is to be erected for the vane, which at this station is kept in excellent order.

Leith, October 20.—In July 1885 the gate of the fence round the thermometers and rain-gauge was repaired, and the thermometer screen made secure. As the glass measure of the rain-gauge is cracked half-way down a new one is desirable. There is no spare thermometer at this station. The cloth of the wet bulb was rather dirty with the soot and dust of Leith. The cloth, however, was quite wet, as shown by the dry bulb reading 44°·8 and the wet 41°·3 at 3 p.m., with a dull foggy atmosphere. Instructions were given to have the muslin changed more frequently. In May last the observer removed to 52, Great Junction Street; a comparison of the barometer showed that it had sustained no damage during the removal to its new position.

The pamphlet giving directions regarding the cirrus observations and the code relative thereto were minutely gone over and explained to the observer. He had had considerable difficulty with these observations,

but after the explanations given he quite understood the cirrus code, and will commence to send the reports when the cirrus is noticed by him.

The Observatory, Aberdeen, September 7.—All the instruments were in excellent order. The ground where the Stevenson screen has been placed in the University grounds, has been turfed for some distance round it. The dry and wet bulbs and the maximum thermometer in the screen were lowered 3 inches each; they now stand, dry and wet bulbs 4 feet above ground, maximum thermometer 4 feet 6 inches, and minimum thermometer 3 feet 10 inches.

All the thermometers were again compared with the greatest care with standard thermometer No. 2522, and after several comparisons by Mr. Boswell and myself, substantially the same result was obtained as from the comparison of 1884.

(Signed) ALEXANDER BUCHAN.

November 3, 1885.

(M.O. 2360.)

INSPECTIONS of OBSERVATORIES and ANEMOGRAPHS, 1885.

Yarmouth, August 10 and 13.—The anemograph at the station having been working very inefficiently for some time, I was instructed by Mr. Scott to examine it, and, if possible, determine the causes of its failure. The defective action was in the velocity pencil, which frequently ceased to make a trace upon the paper. On examining the recording apparatus, the supporting arms of the pencil appeared stiff, and I filed the discs of the coupling clutch to give them more play. Having done this I ran the pencil round a great many times upon the curve, and found this defect was entirely removed. Two days later Mr. Watson, the observer, informed me the trace had again failed. I then discovered that the pencil had not been completely lowered on the paper after changing, and as the lifter was too tight to allow of the pencil falling by its own weight no trace was being produced. I accordingly instructed Mr. Watson in future always to press the lifter down as far as it would go after changing. Since he has done this the action of the instrument has been quite satisfactory. The external apparatus was somewhat out of repair, not having been looked to for some years; one cup was loose and would soon have been blown away, and the oil holder had slipped down the cup shaft. These and other defects I set right, and the instrument is now in good order.

Sandwick, Orkney.—The anemograph at this station was inspected on September 5. Not having been cleaned for some years, I found the recording part very clogged and stiff, although the clock was going quite well. The external gear was in good repair, with the exception of the counter shaft, which was much cut and jammed in its bearing. I took it out and filed it up true, and also cleaned it as far as possible without dismounting. As the observer has resigned charge of the instrument and it will have to be taken down and re-erected elsewhere very shortly, I did not think it desirable to thoroughly overhaul it, as that operation would have necessitated my remaining in the place for an uncertain time on account of the weather, which was quite unsuitable on the day of inspection.

Aberdeen, September 11–16.—I thoroughly examined and cleaned all the instruments at this observatory, finding them in good order. The anemograph required some external repairs which I had executed.

Glasgow, September 18 and 19, October 1 and 2.—The two thermograph tubes and the wet bulb standard thermometer having been

accidentally broken, as well as the supporting frame, I took a set of new thermometers down with me from the stock preserved at the Kew Observatory and set them up. The brass work having been repaired by Mr. White, I had the clock, lenses, &c. all cleaned, and the barograph was similarly treated.

The anemograph was dismounted, thoroughly cleaned, and certain trivial defects made good before it was again started. The rain-gauge was found in good order and was cleaned.

Being compelled by a domestic bereavement to leave Glasgow somewhat hurriedly, I had no time to see to the working of the instruments properly after setting them up, and therefore failed to detect a serious defect in the dry bulb thermograph tube which was brought to my notice by Professor Grant soon after I had returned to Kew. I accordingly went back to Glasgow and found that the mercury in the bore of the thermometer had united at the air speck, which consequently remained at a fixed point in the tube, giving a straight line instead of a temperature curve. I dismounted the tube, and after considerable trouble, succeeded in separating the column, re-blacking the tube, and again setting it up. It has since acted perfectly. The operation will necessitate fresh determination of the thermometer scale and zero values.

Stonyhurst Observatory, visited September 21.—The instruments at this observatory were all found to be in excellent order, and the anemograph well oiled and cared for.

The thermometers were compared and their correction found to be as follows:—

At 55°: Dry bulb	0·0	Maximum — 0·2
Wet bulb	— 0·3	Minimum + 0·1

Mr. Baker's report is subjoined.

(Signed) G. M. Whipple.

October 1885.

Valencia, visited October 9-13.—At this observatory the whole of the instruments were working in a satisfactory manner.

The barograph and thermograph clocks were taken entirely to pieces and cleaned, and the lenses, condensers, and mirrors carefully wiped.

The zero lines were changed to the winter position and the standard thermometers were compared and found to require the following corrections; namely,—

Dry bulb, No. 399 —0·6. Wet, No. 398 —0·5.

The maximum and minimum thermometers were also examined and found in good order, but the scales were re-blackened.

The anemometer was going well and the clock did not require special cleaning. I examined the external parts, but the weather at the time of my visit was too squally to permit of the withdrawal of the velocity shaft; however, care was taken to oil the various bearings well.

The rain-gauge was taken to pieces and the clock thoroughly cleaned.

My attention was called to the small self-recording aneroid recently received at the observatory, which read approximately 0·2 inch higher than the standard mercurial barometer; this was set right and the method of adjustment pointed out to Mr. Cullum.

As regards the old anemometer which was dismounted last year the clock appears in a good state and also the recording parts, with the exception of the pencils, which would require re-grinding or new spirals attached. The cups and direction vane are completely worn out and

quite useless, but the reducing gearing and pillar are in a satisfactory condition.

Falmouth, visited October 19.—All the self-recording instruments were in good order and none of the clocks required cleaning, the whole of them having been done in May last under the direction of Mr. Whipple at the time of shifting them from the old to the new observatory.

A comparison of the standard thermometers gave the following corrections:—

Dry, No. 383 $-0^{\circ}\cdot6$. Wet, No. 388 $-0^{\circ}\cdot3$.

My attention having been called to an irregularity in the temperature trace of the barograph, I made a special examination. I found that it had been rectified the day preceding my visit. The superintendent discovered that the end of the temperature compensation lever had caught in the zero line supporting frame, for cutting off the light. It had probably received a jar which caused its displacement, but he was not aware of such an accident having occurred.

October 29, 1885. (Signed) T. W. Baker.

Report of Inspection of the English Stations, 1885.

I have the honour to submit the following report of the stations in England inspected by me in 1885:—

Jersey (*Noirmont*), September 14.—All the instruments at this station are in good order, and the observer is very careful and intelligent. He shows considerable aptitude for the taking of upper current observations. There are no means of taking observations during Mr. Fisher's absence. A new block will be required for the rain-gauge next year.

Hurst Castle, inspected September 19.—The instruments at this station are all in perfect order. The observer's readings of the barometers are good, but his handling and reading of the thermometers are rough. The maximum temperatures recorded are sometimes much too high; the heat radiated from the white gravel near the instruments may perhaps cause rather high readings, but the errors of the maximum occasionally reported are probably due to carelessness in the setting of the instruments. The substitute who has occasionally taken the readings is inefficient.

On the day of my visit the observer estimated the wind-force correctly, but over-estimated the sea disturbance by one figure. Both the wind-force and sea disturbance appear to be occasionally over-estimated at this station.

Dungeness, inspected September 29.—The instruments at this station were in good order, but the thermometer screen is not very well placed. The barometers are in a very small porch in the house of one of the lightkeepers, which is rather an inconvenient situation.

Yarmouth, inspected October 3.—The instruments were all in good order, and the observations are very carefully taken. I gave instructions for the adjustment of the self-registering aneroid.

Cambridge, October 4.—The barometer was in good order, and the observer reads with perfect correctness, but it may be noted that in winter, at times when the astronomical observations are being taken, the changes of temperature where the instrument is situated are very rapid and great. The minimum thermometer gives low readings, but the other thermometers read well together. Branches of trees slightly interfere, in November, December, and January, and again in June,

with the records of the sunshine recorder. I have reason to hope that the obstruction, which is somewhat on the increase, may be removed.

Loughborough, October 6.—All the instruments at this station were in excellent order, and the observer is exceedingly careful. Although Mr. Berridge has paid great attention to the subject of wind-force, I continue to believe that the number of gales reported from this station is excessive.

York, October 7.—The instruments at this station were not in very good order. The barometer frame was rusty, and required a thorough cleaning, the milled head of the vernier-pinion working with extreme difficulty. This I rectified. The observer read the instrument too high. The thermometer screen required a fresh coat of paint and the rain-gauge was quite worn out. The latter instrument has been moved a few feet for better exposure, but the exposure is still unsatisfactory.

North Shields, October 10.—The thermometer screen and rain-gauge have been shifted to the northward of the former position, but their exposure is still satisfactory. The instruments were all in good condition, and the observer is very painstaking. He estimated the sea disturbance one figure too low on the day of my visit.

Scilly (*St. Mary's*), October 24–30.—I found the instruments at this well-exposed station to be in good condition, excepting that the clock of the self-registering aneroid was out of order.

Prawle Point, November 2.—The observations at this station seem to be very carefully conducted. The instruments were in very good order, but the minimum thermometer reads a trifle too low. The 8 a.m. temperatures during calm summer weather appear to be occasionally somewhat too high, which I am inclined to attribute to the position of the screens.

STATIONS furnishing WEEKLY or MONTHLY REPORTS.

Southampton, inspected September 18.—The observations at this station continue to be very carefully made, and the records are very complete. It has been found necessary to surround the out-of-door instruments with a fence, which does not, however, as I think, affect the readings. The screen required to be re-painted.

St. Leonard's, September 26.—Dr. Colborne had changed his residence a week before the date of my inspection, and a great improvement had just been made in the position of the out-door instruments, which, as now placed in the Gensing Gardens, have a good exposure. The observer was absent at the time of my visit, and I was unable to ascertain the exact altitude of the barometer above sea-level. The instruments were all in good order, and the observations appear to be carefully conducted.

Uppingham, October 5.—The instruments at this station were in good order. The Kew corrections for the maximum appear to be now unreliable, and the readings of all the thermometers require no correction. The screen is a modification of Glaisher's, and is double louvred. The returns from this station are unexceptionable.

Leicester, October 6.—The observer was absent at the time of my visit. Both the dry and the wet-bulb thermometers gave high readings. The instruments generally were in fairly good order, but the rim of the rain-gauge was not horizontal.

Sheffield (*Weston Park*), October 7.—This is a good station, and the exposure of the instruments is excellent. The observations are accurately conducted. I hope that the Park Committee will, in

accordance with my request, permit the screen to be painted white instead of green, as it is at present. A building is about to be erected on the west of the screen, and the latter will then be shifted further to the eastward, when the curator has promised that it shall open to the north, instead of to the east, as it now does. The exposure in the new position will be perfect. The minimum thermometer reads too low, and will be sent to Kew for new corrections. For the present, 9 p.m. observations cannot be taken at this station.

York, October 7.—The observations at this station appear to be fairly well conducted, but a well-situated vane is a desideratum.

Durham, inspected October 8.—Mr. H. J. Carpenter had just commenced the observations here. The readings of the instruments were satisfactory. The cases of the thermometers in use are in bad condition. The observations taken here will in future be at 9 a.m. and 9 p.m.

Seaham, inspected October 9.—The thermometer screen had just been repainted, unfortunately of a dark colour. It is sheltered to some extent by shrubs. The maximum thermometer reads low. There was a considerable deposit of copper on the wet bulb. The rain-gauge required some slight repairs. I think that the observations at this station are more accurately made than was the case a few years ago.

Hawes Junction, inspected October 13.—The observer, Mr. Foster, continues to take the observations carefully. The instruments were in good order, but the dry-bulb read somewhat high. The barometer is in an inconvenient place, but no better site seems to be available.

Stonyhurst, October 15.—The instruments were all in good condition, except that the self-registering rain-gauge required some repairs.

Prestwich (*Manchester*), October 16.—The instruments were in good order, and the work of observation appears to be carefully conducted. The barometer is still unfavourably placed.

Cirencester, October 20.—All the instruments were in a satisfactory condition, and the observer, Professor Ohm, appears to make careful returns.

Arlington Court, October 22.—A new screen has been erected for the convenience of the observer, gardener to Lady Chichester, near to his house, and the 9 p.m. observations of temperature are taken from new thermometers in this screen. It has not so good an exposure as the screen employed for the 9 a.m. readings. The observations are roughly taken, and the returns made from this station are as yet unsatisfactory. This is unfortunate, as the station is well situated.

Plymouth, October 23.—The instruments at this station were all, as usual, in good order, but the maximum thermometer reads high.

Helston, November 1.—The returns from this station have been greatly in arrears, the observer having been repeatedly ill. He expresses himself, however, as anxious to keep on the work. The position of none of the instruments has been altered. The thermometer screen was shaky. I requested Mr. Gill to remedy this at once. The minimum thermometer had 4°·5 of detached spirit, which, being colourless, was not very easily discernible. The other instruments were in good order.

Totnes, inspected November 2.—I found everything, as usual, in excellent order at this station. This is a good station, and the observations are carefully conducted.

St. Aubin's, Jersey.—The returns from this station are admirable. I did not this year compare the thermometers with my own standards, as from time to time Mr. Vibert compares them with a Kew standard of his own.

In the accompanying table (see p. 58) the stations the names of which are printed in italics are those which furnish weekly or monthly reports. In the last column the letter A is employed to signify that the instruments were in perfect condition and well attended to; B that they were in moderately good condition; while C denotes that they were in an unsatisfactory state. These letters do not refer to the correctness or otherwise of the instrumental indications which are shown in the preceding columns, but to the amount of care apparently bestowed on the instruments themselves. The table is otherwise self-explanatory The general result of the comparisons made is, I think, satisfactory.

(Signed) W. Clement Ley.

December 28, 1885.

Name of Station.	Barometer. Difference of Observer's from Inspector's Readings.	Thermometer. Dry Bulb. Temp. of Water.	Dry Bulb. Correction to Inspector's Standard.	Dry Bulb. Correction hitherto applied.	Wet Bulb. Correction to Inspector's Standard.	Wet Bulb. Correction hitherto applied.	Maximum. Correction to Inspector's Standard.	Maximum. Correction hitherto applied.	Minimum. Correction to Inspector's Standard.	Minimum. Correction hitherto applied.	Spare or Grass. Correction to Inspector's Standard.	Spare or Grass. Correction hitherto applied.	General Condition.	Name of Station.
Arlington Court	−·005	49	+0·15		−0·05		+0·35		+0·35				C	*Arlington Court.*
Cambridge	−·000	53	−0·1	−0·1	0·0	+0·2	+0·2	−0·8	+0·9	+0·4			A	Cambridge.
Cirencester		59	+0·1		0·0		−0·15	−0·1	0·0	0·0	+0·4		A	*Cirencester.*
Dungeness	−·003	57	−0·15		+0·25		+0·35		+0·35				A	Dungeness.
Durham	−·000	50	−0·2		−0·25		+0·05		+0·5				A	*Durham.*
Hawes Junction	+·001	41	−0·55		+0·2		−0·05		+0·15				B	*Hawes Junction.*
Holdon	−·002	51	0·0		−0·2	−0·2	+0·05	−0·1	+0·6	+0·5			A	*Holdon.*
Hurst Point	−·002	59	−0·05	−0·1			+0·05		+0·15				A	Hurst Point.
Jersey (Noirmont)	−·001	62	−0·35		−0·35		+0·15		+0·25	−0·2	+0·2		A	Jersey (Noirmont).
Leicester		53	−0·9		−0·9		0·0		+0·2		+0·35		B	*Leicester.*
Loughborough	−·000	50	−0·05	−0·2	−0·05	0·2	+0·05	−0·1	+0·05	+0·5	−0·3		A	Loughborough.
Plymouth		49					−0·05	−0·7	+0·05		+1·7		A	*Plymouth.*
Prawle Point	−·000	48	−0·1		−0·2		−0·2		+0·5				A	Prawle Point.
Prestwick		50	+0·1		−0·1		−0·3		0·0	0·0		+0·1	A	*Prestwick.*
St. Aubin's	−·000	49		0·0		0·0		−0·3					A	*St. Aubin's.*
St. Leonard's		50	−0·2		−0·4		+0·1		0·0				A	*St. Leonard's.*
Scilly	−·000	53	+0·05		+0·25		+0·05	+0·45	+0·45	0·0	+0·05		A	Scilly.
Seaham	−·001	49	−0·3		0·0		+0·7	+0·3	+0·5				B	*Seaham.*
Sheffield	−·008	55	0·0	0·0	−0·4	−0·2	+0·3	+0·1	+0·5	−0·3			A	*Sheffield.*
Shields	+·001	48	+0·4		0·0		0·0		+0·3		−7·0	0·0	A	Shields.
Southampton	−·001	62	−0·4		−0·3	−0·1	−1·1	−0·6	−0·1		+0·3		A	*Southampton.*
Stonyhurst	−·001	46	−0·1	−0·3	+0·15	−0·35	+0·2	−0·3	+0·25				A	*Stonyhurst.*
Tetbus	−·001	46	−0·1	−0·1	−0·15	−0·1	−0·2	0·0	−0·1		+0·6	+0·3	A	*Tetbus.*
Uppingham	−·000	53	0·0		−0·05		−0·15		0·0				A	*Uppingham.*
Yarmouth	+·003	53	−0·05		+0·45		+0·25		+0·15				A	Yarmouth.
York	+·004	50	−0·45		+0·35		+0·45		+0·25				B	York.
York	+·004	50	−0·45		−0·35		+0·25		+0·45				B	*York.*

APPENDIX VII.

Method of Dealing with Telegraphic Weather Intelligence.

The operations connected with the preparation and issue of the Forecasts and Storm Warnings have not undergone any material change so far as the home stations are concerned, but the arrangements made by which information of storms met with to the westward of Long. 45° West, is forwarded telegraphically to the Meteorological Office by the Chief Signal Officer of the United States have been improved. These arrangements are referred to more fully further on. The Daily Weather Report also has been improved by the substitution, in the margin, of greatly improved means for the Rainfall.

The Office now receives, when the telegraphic communications are perfect, fifty-four reports every morning, fourteen every afternoon (except on Sundays), and twenty each evening. The interruptions which have occurred at times in the communication with Sumburgh Head and Stornoway have been very slight. The instructions to the observers have been altered during the year, on account of the introduction of sixpenny telegrams.

The foreign reporting stations, 23 in number, extend along the entire western coast of the Continent, from Bodö in Lat. 67° N. to Corunna in Lat. 43° N., and include four stations on the coast of the Baltic, and one in the Mediterranean. The information is received in accordance with arrangements made with the various Meteorological organisations in France, Holland, Germany, Denmark, Norway, and Sweden.

At the British and Irish stations the morning observations are taken at 8 a.m. Greenwich time, and most of the telegrams arrive in London at about 9 o'clock, when the Intelligence Department of the Post Office extracts from them the portions required for its wind and weather reports. They are then transmitted to the Meteorological Office by its private wire, where the majority of them usually arrive between 9 a.m. and 10 a.m.

As the reports come in, the information is entered on a chart, showing for each station at 8 a.m. the barometrical and thermometrical readings, with their respective alterations during the preceding 24 hours, the direction and force of the wind, and the state of the weather, together with any changes of importance which may have been noticed in the course of the preceding day. From this chart, which is preserved in the Office, other charts are drawn for publication in the newspapers, as described further on.

If necessary, telegraphic warnings of storms or of atmospherical disturbance is immediately sent to our own coasts and to foreign countries. A brief telegraphic resumé of the weather is despatched shortly after 11 a.m. to the Harbour Authorities in Jersey. Another telegraphic message, of about 75 words, is sent to the Underwriters'

Association, Liverpool, containing reports of the pressure, wind and weather at 14 stations on the coasts of the British Islands; and a third message of about the same length is forwarded to the Central News and to the Exchange Telegraph Company for despatch to the provinces. The last of these messages consists of a brief statement of the general condition of weather over Western Europe, as shown by the morning reports It is, however, not in the morning only that storm warnings are issued to the coasts, a constant watch being kept during the day, and whenever on the receipt of the regular or of special telegrams the condition of the weather appears to be threatening, cautionary messages are at once issued to such parts of the coast as are thought to be menaced by a gale.

During the year 1885, there were prepared each morning, afternoon, and evening, Forecasts of the weather, for a day in advance; these were drawn up for eleven districts in the British Islands, and issued to subscribers, to certain Clubs, and to many of the London and Provincial newspapers. The districts for which the Forecasts were prepared are those into which the returns for the Weekly Weather Report are divided (p. 67).

About an hour and a quarter is occupied in the preparation and transmission of the provincial and foreign telegrams, and in the drawing up of the "Remarks" and 11 a.m. Forecasts for the London newspapers, so that the MS. copies for the "Times" and other papers are ready for issue soon after 11 a.m.

Charts are prepared daily for newspaper publication as follows :—

For the "Times," - -	two daily, viz.:	for 8 a.m. and 6 p.m.
For the Patent Type-founding Company, on behalf of the "Shipping Gazette," and for distribution to the provincial press -	one „	for 8 a.m.

The 8 a.m. charts are sent out at about 10.15 a.m. and the 6 p.m. chart at about 8.30 p.m. In addition charts are drawn for 8 a.m. and 6 p.m. daily for exhibition at the Office door, together with some remarks and the latest Forecasts issued.

In addition to the charts here referred to, the Patent Type-founding Company are supplied with various diagrams showing the changes in pressure, temperature, rainfall, wind, and weather for the London district. These are engraved *daily* for the "Daily Chronicle," *weekly* for the "Observer" and "Graphic," and *monthly* for the "Miller," and are all accompanied by remarks on the phenomena exhibited.

The draft of the Daily Weather Report, with two charts attached, is drawn on transfer paper, and is ready by noon, when it is at once sent to the lithographer to be printed. The copies for delivery by hand and by early post in London are issued at about 1.30 p.m., while the remainder are received at the Meteorological Office at about 3.30 p.m. whence they are transmitted by post to the subscribers and others.

At about 3 o'clock the 2 p.m. observations taken at twelve home stations, and two foreign stations (Skudesnaes and Rochefort), are received. Copies of these reports are issued, together with the 8 a.m. report, to certain newspapers and subscribers, and two copies of the

"Remarks" (8 a.m. and 2 p.m.) are sent to the Type-founding Company for issue to provincial newspapers, in order to explain the 8 a.m. charts.

From 7 to 7.30 p.m. the twenty evening (6 p.m.) reports arrive and are charted and discussed for the morning daily papers The forecasts and remarks are usually ready by 8.30 p.m., but in bad weather, owing to the delay of the reports and the additional care which is necessary in dealing with them, it is occasionally 9 p.m. before they are issued. The "Times" publishes in its First Edition the map showing the distribution of pressure, the winds, temperature, and weather at 6 p.m. on the previous day, and in its Second Edition a similar map for 8 a.m. on the day of issue.

The official chart for 2 p.m. and for 6 p.m. is still much less complete than that for 8 a.m.* That for 2 p.m. is drawn on the information received from twelve home stations, supplemented by two foreign ones, whenever the latter arrive in time to be used. The material for the 6 p.m. charts is now supplied by reports from sixteen stations in the United Kingdom, supplemented by four from continental stations, but the latter frequently arrive late at the very time when they are most wanted, *i.e.*, during bad weather.

The Sunday duty is still conducted as follows:—Two of the clerks attend on Sunday mornings at the Central Telegraph Station from 8.30 a.m. to about 10.15 a.m. By an arrangement with the Post Office these clerks are supplied with the telegrams immediately they arrive in London. These are examined and charted, with the view of issuing, when necessary, warnings of coming storms, to our own and neighbouring coasts. It is necessary that promptitude should be observed in this service, as the observations must be dealt with and the warnings issued so that the latter may reach the coast before the telegraph offices close for the day, which is usually at about 10 a.m. No work of any kind is transacted for the newspapers on Sunday mornings, the main object of the service being to give prompt information of storms to our coasts; but a telegram is sent to Jersey in the same way as on week days, and there is the ordinary interchange of messages with foreign countries. At 6 p.m. the same clerks attend at the Meteorological Office to receive the evening reports and to prepare the 8.30 p.m. Forecasts, and another opportunity is thus afforded for the correction or extension of any warnings which may have been issued in the morning.

Atlantic Telegrams.

In the course of the year the arrangements for forwarding from the United States occasional reports of gales, icebergs, and derelict ships, which have been met with by passenger steamers of the principal lines running from various European ports to New York or Boston have been improved by the addition of the latitude in which the lowest barometer was observed. The facts are then sent by cable to the Meteorological Office in an abbreviated form, as follows:—

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* Steps are being taken to improve both the 8 a.m. and the 6 p.m. charts by obtaining observations from a more extended area.

REPORT of a STORM, and EXPLANATION.

(Say, From New York) to Weather, London.

"Scotia."	19.	Fifteen.	43.	64.	South-west	North-west.	293.	Nine.
Name of steamer supplying the information.	Date of lowest barometer.	Hour of lowest barometer. (=3 p.m.)	In which lowest barometer was observed. Lat. N.	In which lowest barometer was observed. Long. W.	Direction of change of wind, about time of lowest barometer. (=S.W. to N.W.)		Lowest barometer observed. (=29·3 inches.)	Extreme force of wind during the storm. (=9, Beaufort's scale.)

Reports of ice and derelict ships relate to ice or derelicts seen on any part of the passage, and are worded thus:—

"Scotia."	Icebergs.*	Thirteen.	Forty-three.	Fifty-four.
Name of steamer supplying the information.	Nature of ice observed.	Day of month when observed.	In which the ice or derelict was observed. Lat. N.	In which the ice or derelict was observed. Long. W.

When a report of ice or of derelict ships is appended to one of a storm, the ship's name is not inserted unless the report of the storm and that of the derelict (or ice) be from different ships.

This information is published in the Daily Weather Report, and is also transmitted to the Meteorological Institute of France. A copy is sent regularly to Lloyd's.

Daily Weather Report.

Some little change has been made in the form of the Daily Weather Report since 1st January 1885, by the addition for each month of means of the daily maximum and minimum temperatures at 22 stations during the nine years 1872–80. The information now fills four large quarto pages, and is arranged as follows:—

Page 1 contains the whole of the reports from which the maps for the day (given on page 2) are prepared; and also the 6 p.m. reports of the previous day; page 2 contains (1) a map of North-western Europe showing for 8 a.m. on the date of publication, the distribution of pressure, the prevalent winds, and the sea disturbance, with necessary explanations; together with a table showing the mean atmospheric pressure for the month at 22 stations; (2) a similar map showing the distribution of temperature at 8 a.m., the weather at each station, and the distribution of rainfall during the past 24 hours; together with a table of the mean temperature of the air and of evaporation at 8 a.m., the means of the

* "Derelict" is substituted for icebergs when necessary.

daily maximum and minimum temperatures, and the mean rainfall for the month at a large number of stations over the United Kingdom.

Page 3 contains (1) remarks on the principal features exhibited by the reports for the day; and (2) the forecasts drawn up for each district at 11 a.m., relating to the weather likely to be experienced during the 24 hours ending at noon on the day succeeding that of publication.

Page 4 contains the reports and remarks for 2 p.m. on the previous day, and there is space for the insertion of a Weekly Summary on Mondays, and any other brief information which it is deemed necessary to print at once.

The standing portion of the report (the maps, &c.) is printed in blue, while the information for each day is in black.

Weekly Summary.

On Monday in each week a brief Summary of the Weather experienced over our Islands during the preceding week is given on p. 4 of the Daily Weather Report. It refers only to the principal changes which have occurred, and is intended to serve as an aid to the study of the Daily Reports, the main meteorological features of the week being presented as a connected story, affording greater facility for future reference.

Correction and Addition List.

Additional steps are taken to insure accuracy in the Daily Weather Report. At the close of each month a return is received from nearly all of the telegraphic reporting stations, containing a copy of all the observations which have been transmitted to London by wire during the month. These schedules are used for checking the daily telegrams, for the preparation of the average and other values of the different elements, and also as evidence in the case of legal proceedings. About the middle of every month a lithographic sheet has for many years past been issued with the Daily Weather Report, containing corrections for all discrepancies which have been discovered, and supplying any observations which have been omitted in the published reports. This monthly sheet also contains tables showing the mean values for pressure, temperature, and humidity, together with the total rainfall, and the prevalence of various kinds of weather and of winds from each of the eight principal points during the month, for each telegraphic reporting station within our Islands.

Weekly Weather Report.

The Weekly Weather Report, which has appeared since the beginning of February 1878, has been further improved by the insertion on the first page, for each district, the difference between the aggregate number of day-degrees of accumulated heat above and below 42° F., as well as of rainfall and bright sunshine between the beginning of the year and the end of each week, and the means for the corresponding period of the eight years 1878–85.

The tables of Accumulated Temperature are designed to give persons engaged in agriculture better means of estimating the manner in which

vegetation is affected by temperature than that afforded by the more usual methods of treating the readings of the thermometer. They show for each week, and for the whole period from the beginning of the year, the weekly and progressive values respectively, of the combined amount and duration of the excess or defect of the air temperature, above or below a suitably fixed standard or *base temperature*. The base adopted is 42° F., as being nearly equivalent to 6° Cent., which has been considered by Continental writers on these subjects to be the critical value, the temperature above which is mainly effectual in starting and maintaining the growth, and in completing the ripening, of agricultural crops in a European climate. This base is also convenient as being 10° F. above the Freezing Point.

The Report thus contains the average and extreme temperatures and the rainfall values and the total amount of bright sunshine in each week, for seventy stations grouped into eleven districts in Great Britain and Ireland, together with the difference between them and their respective mean values for the corresponding weeks in previous years. In addition to this, the district values for Accumulated Temperature, Rainfall, and Bright Sunshine are given, both for the week and for the whole period since the beginning of the year, with their difference from the average values.

The accumulated Temperature is expressed in Day-degrees; a Day-degree signifying 1° F. of excess or defect of temperature above or below 42° F. and continued for 24 hours, or any other number of degrees for an inversely proportional number of hours.

It has been ascertained by calculation from a considerable series of hourly observations at various places, that the accumulated temperature may be computed, with a very tolerable approximation to the truth, from the observed daily maximum and minimum temperatures alone.

When the temperature during any period remains either wholly above or below the base temperature, the difference between the base and the mean temperature gives the correct accumulated value. In other cases this difference gives an approximate value of the accumulated temperature which does not depart greatly from the truth, the deviation depending on the greater or less extent of the daily variations of the temperature above or below the base. Further, since the mean between the maximum and minimum of any day is nearly equal to the mean temperature of the day, the difference of the mean of the maximum and minimum from the base also will give directly a fair approximation to the accumulated temperature for the day.

The following rules, however, supply a still closer approximation to the true values sought, and they have been adopted for the preparation of the table in the Weekly Weather Report. They may be applied to any other base temperature as well as to 42° F., with the slight modification of the numerical coefficients.

RULES for computing for a WEEKLY PERIOD the ACCUMULATED TEMPERATURE above or below 42° F. from the observed MAXIMA and MINIMA.

1. Obtain the mean temperature from the means of the seven observed maxima and minima by multiplying the difference between them by the proper coefficient for the month, and adding the result to the mean of the minima.

2. In obtaining the accumulated temperature four cases may occur, to which the following rules will apply :—

Conditions of Temperature	To obtain the Accumulated Temperature.	
	Above 42° F.	Below 42° F.
If the minimum is *above* 42° F. or *equal* to 42° F.	Subtract 42° F. from the mean.	There is none.
If the minimum is *below* 42° F., but the mean for the day is *above* 42° F.	From the difference between the mean for the day and the minimum deduct the accumulated temperature below 42° F., calculated as stated in the next column.	The required quantity is the excess of 42° F. over the minimum multiplied by the coefficient 0·4.
If the mean for the day is *below* 42° F., but the maximum is *above* 42° F.	The required quantity is the excess of the maximum over 42° F. multiplied by the coefficient 0·4.	From the difference between the mean for the day and the minimum deduct the accumulated temperature above 42° F., calculated as stated in the preceding column.
If the maximum is *below* 42° F., or *equal* to 42° F.	There is none.	Subtract the mean from 42° F.

In each case the result will be the mean *daily* value for the week, and must be multipled by 7 in order to obtain the value for the whole week.

The coefficient varies both with the length of the period and the value of the base line. In the above instance the base is 42°; when it is 32° the coefficient is 0·4; when 52° it is 0·33; and when 62° it is 0·25.

A full explanation of these rules will be found in Appendix II. to the Quarterly Weather Report for 1878.

The temperature means derived from the daily maxima and minima are corrected so as to agree as closely as possible with the true mean daily value, and, the average values for the corresponding period in former years having been recomputed, those now in use are :—

For Temperature - - 20 years 1861–80
„ Rainfall - - 15 „ 1866–80

These statistics are given on page 1 of the publication, the temperature, accumulated heat, rainfall, and sunshine values for *each station** being given on page 4.

In addition to the telegraphic reports, and the returns from the self-recording observatories, weekly returns from 34 volunteer observers are used in preparing this report, the names of the observers at each station being as under—

Names of Stations.	Names of Authorities.
Alnwick Castle - - -	Lieut.-Col. F. Holland, for the Duke of Northumberland, K.G.
Arlington (N. Devon) - -	J. Carter, for Lady Chichester.
Bawtry (Hesley Hall) - -	B. I. Whitaker, F.R. Met. Soc.
Blackpool - - -	C. T. Ward, F.R. Met. Soc.

* The sunshine values are furnished for only a limited number of carefully selected stations.

Names of Stations.	Names of Authorities.
Brookeborough - - -	Mr. Ferguson, for Sir Victor Brooke, Bt., F.L.S.
Cheadle - - - ℳ	J. C. Philips.
Churchstoke - - ℳ	P. Wright, F.C.S., F.R. Met. Soc.
Cirencester - - -	The Royal Agricultural College.
Cullompton - - ℳ	T. Turner, J.P., F.R. Met. Soc.
Douglas (Isle of Man) -	A. W. Moore, M.A., J.P., Cronkbourne.
Dublin - - -	J. W. Moore, M.D., F.R. Met. Soc.
Durham - - -	J. H. Carpenter.
Edgeworthstown (Currygrane) -	J. M. Wilson, J.P.
Foynes - - -	T. J. Carey, for Lord Monteagle, K.P.
Geldeston - - -	E. T. Dowson, F.R. Met. Soc.
Hastings (St. Leonard's) -	H. Colborne, M.R.C.S.
Hereford - - ℳ	T. A. Chapman, M.D.
Hillington - - ℳ	Rev. H. E. B. Ffolkes, M.A., F.R. Met. Soc.
Ingatestone - - -	L. Petre.
Kilkenny - - -	H. Carlton, for the Marquis of Ormonde.
Killarney - - -	The Ven. Archdeacon Wynne, M.A., F.R. Met. Soc.
Laudale (Loch Sunart) -	A. Fletcher, for T. H. G. Newton, F.R. Met. Soc.
Leicester - - -	J. C. Smith, the Museum.
Llandovery - - -	J. Watkins.
Llandudno - - ℳ	J. Nicol, M.D., F.R. Met. Soc.
Londonderry - -	J. Conroy, F.R. Met. Soc.
Manchester (Prestwich) -	T. R. H. Clunn, M.D., F.R. Met. Soc.
Markree Castle (Sligo) -	A. Marth, F.R.A.S., for Colonel Cooper, F.R.A.S.
Newton Reigny (Penrith) -	T. G. Benn, F.R. Met. Soc.
Plymouth - - -	J. Merrifield, LL.D., F.R.A.S.
Rothamsted - -	Rainfall by Sir J. B. Lawes, Bart., LL.D., F.R.S., and J. H. Gilbert, Ph.D., F.R.S., temperature by T. Wilson, F.R. Met. Soc.
Scarborough - - ℳ	A. Rowntree, F.R. Met. Soc.
Southampton - -	J. T. Cook, R.E., Ordnance Survey Office.
Stowell - - ℳ	Rev. H. J. Poole, F.R. Met. Soc.
Strathfield Turgiss - ℳ	Rev. C. H. Griffith, F.R. Met. Soc.
Waterford (Brook Lodge) -	C. Percival Bolton.

The returns marked "ℳ" are supplied through the Royal Meteorological Society.

Owing to the removal to another part of the country of the Reverend T. A. Preston, M.A., F.R.Met.Soc., the returns from Marlborough have ceased, and those from Stowell have been substituted.

The report is prepared on Wednesday in every week, and is ready for sale early on Saturday morning, but the summary on its first page is sent to the "Times," "Daily News," and some other papers on Wednesday evening.

A *Quarterly Summary* of the Weekly Weather Report has been also issued as an Appendix, giving for each of the 12 districts before referred to (1) the Mean Temperature for each Quarter and for the Whole Year in each year from 1878 to 1885 inclusive, and the means for certain groups of years; (2) the Total Rainfall for the same periods; and (3) the Accumulated Temperature, Rainfall, and Bright Sunshine for the Quarter.

Monthly Weather Report.

During 1885 the issue of the *Monthly Weather Report* has been continued. It contains (1) A General Summary for the Month of the weather experienced over the United Kingdom and its neighbourhood; (2) Tables of the principal Cyclonic and Anticyclonic Systems which have passed over our area during the month; and (3) Tables of Pressure, Temperature, Hygrometric Deductions, Rainfall, Weather, Wind, and Bright Sunshine experienced at a large number of stations scattered over the United Kingdom, together with remarks thereon, and is illustrated by two plates. The report is, therefore, as far as possible, similar to the Quarterly Weather Report, but owing to its prompt issue, it cannot contain either the Gale Tables, or the Tables of Mean Values for the Observatories, which are found in its predecessor. The volume for 1885 has two appendices.

Issue of Forecasts.

Descriptions of the actual state of the weather, and forecasts *for not more than one day in advance*, are prepared at the Meteorological Office as under:—

On Week Days.

(1.) At 11 a.m. (from the morning reports), for the 24 hours ending at Noon on the day following the date of issue. This issue is intended especially for the early editions of the evening papers, for the clubs, and for exhibition at certain selected stations. See note, p. 10.

(2.) At 3.30 p.m. (from the morning and afternoon reports), for the day following that of issue. This set of Forecasts is not intended for general publication, but a copy is exhibited regularly at the door of the Meteorological Office.

(3.) At 8.30 p.m. (from the 6 p.m. reports), for the day following that of issue. These are now supplied gratis to any newspaper or news agency which may apply for them, and send for them regularly. A very large number of the most important papers avail themselves of this advantage.

The forecasts are made for the following districts:—

0. Scotland, North.
1. Scotland, East.
2. England, N.E.
3. England, East.
4. Midland Counties.
5. England, South.
6. Scotland, West (with Isle of Man).
7. England, N.W. (with North Wales).
8. England, S.W. (with South Wales).
9. Ireland, North.
10. Ireland, South.

The descriptions and forecasts are posted at the doors of the Meteorological Office, 116, Victoria Street, S.W., on week days, for the inspection of the public. Copies, or extracts from them, are communicated under the conditions stated on next page, but no information which is not substantially included in them can be supplied.

FORECASTS FOR PRIVATE SUBSCRIBERS.—Any person can be supplied with a copy of the 11 a.m. Forecasts, once on each week day,* on payment of a subscription of ten shillings per annum, or 2*s.* 6*d.* per official quarter *or any part thereof, in addition to the cost of transmission;* the charges will therefore be, by *letter* post, 9*s.*, by *book* post, 5*s.* 9*d.* per quarter.

FORECASTS FOR CLUBS.—Forecasts, drawn up at 11 a.m., for all the districts, are supplied to Clubs, for a subscription of ten shillings per annum. These are delivered free, by hand, to Clubs situated in or near Pall Mall. Special arrangements can be made for delivery at a greater distance by hand or by post.

SUBSCRIBERS FOR THE LITHOGRAPHED COPY OF THE DAILY REPORT have the 11 a.m. Forecast incorporated with their Report on each week day. The subscription for the Report is—

For delivery by hand, where feasible, £2 *per annum;*
Do. by book post £1 „

N.B.—Subscriptions must be paid in advance, and end at the usual official quarter day. The subscription for any part of an official quarter is charged as a complete quarter.

Unless otherwise arranged, all forecasts transmitted by post are sent by book post, not as letters.

INQUIRIES as to the WEATHER.

INQUIRIES PERSONALLY OR BY MESSENGER.—Any person applying at the Meteorological Office between 11 a.m. and 8 p.m. on week days, and between 7 p.m. and 8 p.m. on Sundays, can be supplied in writing with the latest information in the possession of the Office and with the latest forecast issued for any specified district, on payment of one shilling for each inquiry.

INQUIRIES BY LETTER.—Application may be made by letter, enclosing thirteen pence in stamps if the reply is to be *by post*, and one shilling in stamps in addition to the cost of the reply, consisting of ten words, exclusive of the address, if the reply is to be *by telegraph*.

INQUIRIES BY TELEGRAPH.—Any person may obtain *by telegraph* from the Meteorological Office the latest information as to the weather in any district of the United Kingdom by payment of a fee of 1*s.* In addition to the cost of a telegram and reply to any post office, the telegram containing the inquiry must be addressed as follows:

WEATHER,
LONDON.

The payment for the reply should be for ten words in addition to the address.

Application may also be made for similar information to be sent either *by telegraph* or *post* on some future specified day.

CHECKING of FORECASTS.

In order to test the accuracy of the forecasts they have been compared carefully with the weather reported in the various districts on the days to which they referred, and the results of this checking for 8.30 p.m. have been already given in the Report (p. 10). The details will be found in Appendix XI.

In carrying out this comparison the portions of the forecasts which referred to wind have been carefully separated from those relating to weather. The detailed results of the comparison will be found in Appendix XI., p. 75.

* Good Friday and Christmas Day are reckoned as Sundays.

Checking of Storm Warnings.

The testing of the warnings is conducted in the following manner. The intelligence issued is compared with the weather experienced on the coasts, as indicated by the various self-recording anemometers, by the telegraphic reporters, and by several gentlemen who have volunteered to observe for the Office, and whose names will be found in Appendix XIV.

In order to render the information in the possession of the Office as to the weather experienced on our coasts still more complete, the Council have, as in preceding years, made application to the various Light-house Boards, and have obtained from them the original log-books from some of the most exposed lightships and lighthouses. They would here express their cordial thanks for the co-operation so readily granted to them by these Boards.

The result of the checking for 1885 will be found on p. 14.

The coasts are subdivided into nine districts, as will be seen in the table. Two large tracts of coast are entirely omitted: viz., the west of Ireland from the Shannon to Malin Head, and the West of Scotland from the Mull of Cantyre to Cape Wrath. No warnings are issued to any place within the limits indicated, except to Galway, and the amount of information as to the weather received from the omitted tracts of coast is, as yet, very scanty.

It should be remembered that in analysing the reports, all observations of the wind in which the force *exceeded* 7 (a "moderate gale") or the velocity exceeded 40 miles an hour, have been quoted as instances of the occurrence of a gale; but it has not been considered that the signal was hoisted late or was hauled down too soon, unless the force of 9 (a "strong gale") or the velocity of 50 miles an hour, was reached prior to the issue of the order to hoist, or subsequent to the issue of the order to lower.

In the Summaries all cases in which the signal has been shown to be late by a single report either of force 9, or of a velocity of 50 miles an hour, have been specially noted.

APPENDIX VIII.

List of Persons, Places, &c. to which the Lithographed Daily Weather Report is supplied, free of cost.

Newspapers:

Lloyd's Shipping List.
New York Herald.
Times (1st and 2nd editions).

For Exhibition at Seaports:

Banff.
Belfast.
Blackpool.
Bo'ness.
Boscastle.
Brighton.
Briton Ferry.
Broughty Ferry.
Buckie.
Budehaven.
Caernarvon (2).
Cork.
Cowes.
Cromer.
Cullercoats.
Dover.
Dundee.
Exeter (2 copies).
Falmouth.
Glasson Dock, Lancaster.
Great Grimsby (2 copies).
Groomsport.

For Exhibition at Seaports—cont.

Hastings.
Hayle.
Holyhead.
Kingstown.
Leith.
Lowestoft.
Margate.
Morecambe (2).
Nairn.
Newquay.
Penarth.
Plymouth.
Plymouth G. W. Docks.
Port Dinorwic.
Porthcawl.
Queenstown.
St. Leonard's.
St. Sennen Cove.
Scarboro'.
Silloth.
Southport.
Teignmouth.
Ventnor (2 copies).
Weston-super-Mare.
Wisbech.
Yarmouth.

Offices, Societies, &c.:

Admiralty: 12 copies.
Aldershot, Garrison Library.
Army Medical Department.
" " Woolwich.
Ben Nevis Observatory.
Board of Trade: 3 copies.
"Britannia," H.M.S., Dartmouth.
British Museum.
Commons, House of.
Deptford, Naval Storekeeper.
Devonport Dockyard: 2 copies.
" Commander-in-Chief.
" Captain of Steam Reserve.
" Master Attendant.
Durham, University Observatory.
Dublin, General Register Office.
Farnborough Station, Staff Commandant's Clerk.
General Register Office.
" " " for Seamen.
Greenwich Observatory.
" R.N. College.
"Indus," H.M.S., Devonport.
Ireland, Royal College of Science.
Leicester Museum.
Lords, House of.
Meteorological Council: 2 copies.
"Nankin," H.M.S., Milford Haven.
Navy Medical Department.
Observatories: 7 copies.
Ordnance Survey Office (Southampton).
Portland, Senior Naval Officer.
Portsmouth, Commandor-in-Chief.
" Dockyard.
" R. N. College Observatory.
Prestwich Asylum, near Manchester.
Queenstown, Rear-Admiral.
Radcliffe Observatory, Oxford.
"Resistance," H.M.S., Rock Ferry.

Offices, Societies, &c.—cont.

Royal Indian C.E. College, Cooper's Hill.
„ Meteorological Society.
„ Military Academy.
„ Society (2).
Rugby Natural History Society.
Science and Art Department: 2 copies.
Scottish Meteorological Society.
Sheerness, Commander-in-Chief.
„ Dockyard.
Sheffield, Public Museum.
Southport, Fernley Observatory.
War Office, Adjutant General, Horse Guards.
„ Commander-in-Chief.
Yorkshire Philosophical Society.

Miscellaneous:

Agents: 2 copies.
Aird, G. H., Seaham.
Bellingham, J. G., Saffron Walden.
Benn, T. G., F.R. Met. Soc., Newton Reigny.
Buchan, A., F.R.S.E., Edinburgh.
Chatham, The Instructor in Surveying. (2 copies.)
Clark, J. E., York.
Colborne, H., St. Leonard's.
Conroy, J., F.R. Met. Soc., Londonderry.
Cooper, Col., F.R.A.S., Markree, near Sligo.
Crossley, Mrs., Halifax.
De La Rue and Co.
Dowson, E. T., F.R. Met. Soc., Geldeston, Beccles.
Eastern Telegraph Co.
Farrer, Sir T. H., Bart.
Freeden, W. H. von, Bonn.
Griffith, Rev. C. H., F.R. Met. Soc., Strathfield Turgiss.
Jackson, H. Kains, London.
Ley, Rev. W. C., M.A., Lutterworth.
Mann, J. R., Osborne.
Mellish, H., F.R. Met. Soc., Worksop.
Miller, S. H., F.R.A.S., Lowestoft.
Moore, A. W., Isle of Man.
Moore, F. W., Glasnevin, Botanic Gardens, Dublin.
Moore, J. W., M.D., F.R. Met. Soc., Dublin.
Mullins, Rev. G. H., F.R. Met. Soc., Uppingham.
Northumberland, Duke of, Alnwick.
Propert, W. P., LL.D., F.R. Met. Soc., St. David's.
Richards, Adm. Sir G. H., K.C.B., F.R.S., London.
Richards, W. H., Penzance.
Rosse, Earl of, F.R.S., Parsonstown.
Stow, Rev. F. W., M.A., F.R. Met. Soc., Aysgarth, Bedale.
Telegraphic Reporters (25).

Foreign Places:

Algiers, Meteorological Service.
Amsterdam Meteorological Institute.

Foreign Places—cont.

Bombay, Observatory.
Brussels, Royal Observatory.
Cairo, Laboratoire Khédivial.
Calcutta, Meteorological Department.
Chemnitz, Meteorological Service of Saxony.
Christiania, Meteorological Institute.
Constantinople, Imperial Meteorological Observatory.
Copenhagen, Meteorological Institute.
Cracow, Observatory.
Florence, Museum.
Hamburg, Deutsche Seewarte.
Lisbon, Observatory.
Madrid, Royal Observatory.
Melbourne, Observatory.
Paris, Central Meteorological Bureau.
„ Meteorological Society.
„ Ministry of Marine.
Rome, Meteorological Institute.
San Fernando, Observatory.
St. Petersburg, Central Physical Observatory.
Stockholm, Meteorological Institute.
Toronto, Meteorological Office.
Upsala, University Observatory.
Utrecht, Royal Meteorological Institute.
Vienna, Imperial Meteorological Institute.
Washington, Smithsonian Institution.
„ United States Naval Observatory.
„ Chief Signal Officer, War Office.
Zürich, Central Meteorological Institute.

APPENDIX IX.

Fishery Barometers.

List of Places supplied with Fishery Barometers.

Shetland Isles.—Balta Sound, Uya Sound, Lerwick, Sandsair, Symbister, Scalloway.

Orkney Isles.—Burray. Kirkwall.

Scotland, east coast.— Stroma, Keiss, Staxigoe, Wick, Sarclet, Lybster, Dunbeath, Portmahomack, Cromarty, Avoch, Nairn, Burghead, Portessie, Port Knockie, Portsoy, Whitehills, Gardenstown, Rosehearty, Pitullie, Inverallochy, Pointlaw, Port Erroll, Findon, Portlethen, Muchals, Stonehaven, Arbroath, Broughty Ferry, St. Andrews, Crail, Cellardyke, St. Monance, Burntisland, Newhaven.

England, east coast.—Berwick, Beadnell, North Shields, South Shields, West Sunderland, Hartlepool, Staithes, Scarborough, Filey, Flamborough, Bridlington Quay, Withernsea, Hull, Lynn (2), Wells, Gorleston, Harwich, Brightlingsea, Wivenhoe, Margate, Deal (2), Kingsdown, Dover.

England, south coast.—Bognor, Portsea, Ryde and Ventnor (2) (Isle of Wight), Gorey (Jersey), Haslar Hospital, Poole, Weymouth, Portland, Budleigh-Salterton, Cawsand, Charlestown, Mevagissey, Gorranhaven, Devoran, Portscath, Penryn, Durgan, Porthallow, Falmouth, Coverack, Newlyn, Mousehole.

England, south-west coast.—St. Ives, Hayle, Padstow, Port Isaac, Boscastle, Fremington, Burnham, Highbridge, Weston-super-Mare.

Wales.—Briton Ferry, Swansea, Angle, Milford, Abersoch.

England, north-west coast.—Fleetwood, Morecambe, Maryport.

Isle of Man.—Douglas, Port St. Mary, Peel.

Scotland, south-west coast.—Port Patrick, Stranraer.

Ireland, east coast.—Cushendall, Belfast, Bangor, Groomsport, Donaghadee, Strangford, Ardglass, Carlingford, Greenore, Dundalk, Malahide, Howth, Kingstown (2), Bray.

Ireland, south coast.—Dunmore, Dungarvan, Crosshaven, Kinsale, Union Hall, Castletownsend, Baltimore, Schull, Crookhaven.

Ireland, west coast.—Valencia, Dingle, Tralee, Tarbert, Kilcredane, Barna, Elly Bay, Ballyglass, Ballycastle (Co. Mayo), Donegal, Tribane, Killybegs, Teelin, Portnoo, Burton Port, Bunbeg.

Ireland, north coast.—Dunfanaghy, Rathmullen, Buncrana, Greencastle, Portrush, Portstewart.

Scotland, west coast.—Tarbert, Campbeltown, Carradale, Portree (Isle of Skye), Plockton.

Hebrides.—Stornoway, Cromore, Babyle, Obb, Ness.

SUMMARY of STATIONS supplied with INSTRUMENTS.

England and Wales - - - - - -	69
Scotland - - - - - - -	54
Ireland - - - - - - -	46
	169

APPENDIX X.

TELEGRAPHIC WEATHER INTELLIGENCE.

The following stations are supplied with telegraphic information of storms, free of expense, and signal "cones" have been furnished to most of them, all further expenses attendant on the maintenance and repair of the apparatus being borne locally. The stations are situated.

82 in England and Wales, 38 in Scotland, 15 in Ireland, 3 in the Isle of Man, and 3 in the Channel Islands.

NORTH.	WEST.	SOUTH.	EAST.
SCOTLAND. EAST COAST.	ENGLAND, N.W.	ENGLAND, S.W.	ENGLAND, E.
Dunrossness.	Ramsey.	Ilfracombe.	Eyemouth.
Lerwick.	Douglas.	Barnstaple.	Berwick-on-Tweed.
Scalloway.	Castletown.	Appledore.	Tynemouth.
Kirkwall.	Silloth.	Boscastle.	S. Shields.
Holborn Head.	Maryport.	Port Isaac.	Sunderland.
Wick.	Workington.	Newquay.	Middlesborough.
Inverness.	Whitehaven.	Hayle.	Redcar.
Nairn.	Barrow.	Scilly.	Whitby.
Burghead.	Morecambe.	St. Sennen.	Filey.
Lossiemouth.	Fleetwood.	St. Just.	Bridlington Quay.
Buckie.	Blackpool.	Penzance.	Hull.
Portsoy.	Lytham.	Falmouth.	Goole.
Banff.	Southport.	Pendennis.	Grimsby.
Fraserburgh.	Runcorn.	Mevagissey.	Boston.
Peterhead.	Liverpool.	Plymouth.	Sutton Bridge.
Aberdeen.	ENGLAND, W.	Teignmouth.	Lynn.
Stonehaven.	Connah's Quay.	Exmouth.	Sheringham.
Montrose.	Port Penrhyn.		Cromer.
Broughty Ferry.	Holyhead.		
St. Andrews.	Port Dinorwic.		
Dundee.	Carnarvon.		
Bo'ness.	Aberystwith.	ENGLAND, S.	ENGLAND, S.E.
Grangemouth.	Milford.	Guernsey.	Yarmouth.
Anstruther.	Pembrey.	St. Helier's (Jersey).	Southwold.
Pittenweem.	Swansea.	Gorey (Jersey).	Ipswich.
Burntisland.	Llanelly.	Weymouth.	Harwich.
Granton.	Brixon Ferry.	Poole.	Chatham.
Newhaven.	Porthcawl.	Cowes.	Sheerness.
Leith.	Penarth.	Ryde.	Faversham.
Fisherrow.	Cardiff.	Portsmouth.	
Dunbar.	Newport.	Littlehampton.	
Cockburnspath.	Weston-super-Mare.	Brighton.	
	Burnham.	Newhaven.	
	Bridgwater.	Hastings.	
	IRELAND, E.	Rye.	
	Belfast.	Dover.	
	Donaghadee.	Margate.	
	Howth.		
FIRTH OF CLYDE.	Kingstown.		
Glasgow.	IRELAND, S. and W.		
Greenock.	New Ross.		
Rothesay.	Dunmore East.		
Campbelton.	Dungarvan.		
Girvan.	Youghal.		
Rallantrae.	Queenstown.		
	Passage.		
	Kinsale.		
	Cork.		
	Tralee.		
	Limerick.		
	Galway.		

The signals used consist of:—

1. Cone, point downwards for Southerly gales; S.E. round by S. to N.W.
2. Cone, point upwards for Northerly gales; N.W. round by N. to S.E.

The signals are to be kept hoisted *during the daylight only*, until 48 hours have elapsed from the time *the telegram was despatched*, unless countermanded. At night, lanterns may be used wherever the local authorities deem it desirable to do so.

The meaning of the signals is that an atmospherical disturbance exists (which will be explained in the telegram), and will probably, but not *necessarily*, cause a gale at the place warned, *from the direction* indicated by the signal.

The Meteorological Office supplies the canvas shapes and lanterns to such places as require them, on loan, but in all cases the local authorities must undertake the charges incidental to the hoisting of the signal, such as flagstaff and gear, oil, &c., and also to the keeping of the apparatus in repair, painting, &c.

APPENDIX XI.

REPORT ON THE COMPARISON OF THE FORECASTS ISSUED AT 8.30 p.m. WITH THE WEATHER SUBSEQUENTLY EXPERIENCED, for the 12 Months, April 1885 to March 1886.

The letters used have the following signification:—

a = complete success.	c = partial failure.
b = partial (more than half) success.	d = total failure.

The checking has been conducted on the same system as that employed in previous years, *i. e.*, each forecast has been considered under the separate headings of "Wind" and "Weather," but the results of the 8 p.m. Forecasts only are here published.

The first column gives the percentage of success in "Wind," the second in "Weather," and the third the average of the two.

The Summary for the whole year is given at page 10.

Districts.		April 1885. Percentages. Wind.	Weather.	Average.	a+b.	May 1885. Percentages. Wind.	Weather.	Average.	a+b.	June 1885. Percentages. Wind.	Weather.	Average.	a+b.
Scotland, N.	a	64	63	64		50	68	59		43	64	54	
"	b	33	30	26	90	30	29	30	89	30	33	31	85
"	c	3	10	7		17	0	8		20	3	12	
"	d	0	7	3		3	3	3		7	0	3	
Scotland, E.	a	37	60	49		43	68	55		30	64	47	
"	b	57	37	47	96	45	23	34	89	47	33	40	87
"	c	6	0	3		10	0	5		17	0	9	
"	d	0	3	1		3	9	6		6	3	4	
England, N.E.	a	60	53	57		45	68	57		37	70	54	
"	b	30	37	33	90	38	26	31	88	37	24	30	84
"	c	10	10	10		16	6	11		23	3	13	
"	d	0	0	0		3	0	1		3	3	3	
England, E.	a	54	23	39		61	65	63		43	70	57	
"	b	33	50	41	80	29	23	26	89	27	20	23	80
"	c	7	17	12		10	6	8		23	7	15	
"	d	6	10	8		0	6	3		7	3	5	
Midland Cos.	a	37	43	40		62	58	60		43	57	50	
"	b	37	40	39	79	32	23	28	88	37	37	37	87
"	c	16	10	13		3	16	9		13	6	10	
"	d	10	7.	8		3	3	3		7	0	3	
England, S.	a	53	43	48		78	65	72		44	73	59	
"	b	30	50	40	88	16	29	22	94	43	27	35	94
"	c	10	0	5		6	3	5		10	0	5	
"	d	7	7	7		0	3	1		3	0	1	
Scotland, W.	a	44	60	52		49	58	54		30	60	45	
"	b	33	27	30	82	39	23	31	85	27	23	25	70
"	c	10	3	7		6	3	4		0	10	20	
"	d	13	10	11		6	16	11		13	7	10	
England, N.W.	a	44	60	52		42	55	49		33	60	47	
"	b	43	27	35	87	42	32	37	86	47	23	35	82
"	c	7	10	9		13	7	10		13	10	11	
"	d	6	3	4		3	6	4		7	7	7	
England, S.W.	a	54	37	46		58	55	57		50	60	55	
"	b	40	37	38	84	29	39	34	91	30	23	27	82
"	c	3	20	12		10	3	6		10	10	10	
"	d	3	6	4		3	3	3		10	7	8	
Ireland, N.	a	44	60	52		36	71	54		45	60	53	
"	b	43	27	35	87	35	20	27	81	31	23	27	80
"	c	7	7	7		23	3	13		21	10	15	
"	d	6	6	6		6	6	6		3	7	5	
Ireland, S.	a	30	50	40		52	68	60		38	63	51	
"	b	43	37	40	80	32	23	28	88	38	17	27	78
"	c	10	10	10		16	9	12		17	10	14	
"	d	17	3	10		0	0	0		7	10	8	
Summary.													
British Isles	a	48	50	49		52	64	58		40	64	52	
"	b	38	35	37	86	33	26	30	88	36	26	31	83
"	c	8	9	8		12	5	8		18	6	12	
"	d	6	6	6		3	5	4		6	4	5	

Districts.		July 1885. Percentages. Wind.	Weather.	Average.	a+b.	August 1885. Percentages. Wind.	Weather.	Average.	a+b.	September 1885. Percentages. Wind.	Weather.	Average.	a+b.
Scotland, N.	a	55	45	50		42	61	52		30	44	37	
"	b	26	42	34	84	39	29	34	86	54	40	47	84
"	c	16	3	10		13	3	8		13	13	13	
"	d	3	10	6		6	7	6		3	3	3	
Scotland, E.	a	48	68	58		39	55	47		43	37	40	
"	b	39	20	30	88	45	26	36	83	37	37	37	77
"	c	13	6	9		13	13	13		13	16	15	
"	d	0	6	3		3	6	4		7	10	8	
England, N.E.	a	45	58	52		49	61	55		47	40	44	
"	b	55	29	42	94	32	26	29	84	43	47	45	89
"	c	0	10	5		13	10	12		3	10	6	
"	d	0	3	1		6	3	4		7	3	5	
England, E.	a	53	77	65		65	58	62		50	57	54	
"	b	33	23	27	93	19	26	23	84	47	27	37	91
"	c	16	0	8		10	10	10		3	16	9	
"	d	0	0	0		6	6	6		0	0	0	
Midland Cos.	a	61	71	66		71	55	63		48	47	48	
"	b	36	29	33	99	19	33	26	89	45	33	39	87
"	c	3	0	1		10	12	11		7	17	12	
"	d	0	0	0		0	0	0		0	3	1	
England, S.	a	68	71	70		58	65	62		57	40	49	
"	b	29	26	27	97	26	29	27	89	27	37	32	81
"	c	3	3	3		6	6	6		16	23	19	
"	d	0	0	0		10	0	5		0	0	0	
Scotland, W.	a	49	58	54		42	49	46		20	43	32	
"	b	32	23	27	81	29	35	32	78	50	37	43	75
"	c	13	6	10		10	6	8		17	7	12	
"	d	6	13	9		19	10	14		13	13	13	
England, N.W.	a	58	45	52		48	55	52		37	53	45	
"	b	36	20	28	80	26	29	27	79	43	20	32	77
"	c	6	19	12		10	6	8		10	17	13	
"	d	0	16	8		16	10	13		10	10	10	
England, S.W.	a	68	65	67		23	61	42		37	44	41	
"	b	23	6	14	81	45	26	36	78	43	43	43	84
"	c	9	13	11		26	10	18		10	10	10	
"	d	0	16	8		6	3	4		10	3	6	
Ireland, N.	a	32	65	49		29	52	41		27	40	34	
"	b	45	26	35	84	55	26	40	81	53	47	50	84
"	c	20	9	15		3	6	5		10	13	11	
"	d	3	0	1		13	16	14		10	0	5	
Ireland, S.	a	42	49	46		29	55	42		33	47	40	
"	b	42	29	35	81	42	23	33	75	44	30	37	77
"	c	13	3	8		19	6	12		13	23	18	
"	d	3	19	11		10	16	13		10	0	5	

Summary.

British Isles	a	53	61	57		45	57	51		39	45	42	
"	b	36	35	31	88	34	28	31	82	44	36	40	82
"	c	10	7	8		12	8	10		11	15	13	
"	d	1	7	4		9	7	8		6	4	5	

Districts.		October 1885. Percentages. Wind.	Weather.	Average.	a+b.	November 1885. Percentages. Wind.	Weather.	Average.	a+b.	December 1885. Percentages. Wind.	Weather.	Average.	a+b.
Scotland, N.	a	48	58	53	78	50	54	52	87	52	71	62	91
"	b	23	26	25		30	40	35		39	20	29	
"	c	16	6	11		10	3	7		9	3	6	
"	d	13	10	11		10	3	6		0	6	3	
Scotland, E.	a	45	55	50	84	50	44	47	89	61	61	61	84
"	b	39	29	34		40	43	42		23	23	23	
"	c	6	10	8		7	10	8		10	6	8	
"	d	10	6	8		3	3	3		6	10	8	
England, N.E.	a	39	61	50	89	33	57	45	77	58	55	57	89
"	b	55	23	39		40	23	32		32	32	32	
"	c	3	6	5		17	13	15		10	7	8	
"	d	3	10	6		10	7	8		0	6	3	
England, E.	a	32	45	39	78	37	47	42	84	58	58	58	86
"	b	39	39	39		50	33	42		29	28	28	
"	c	26	3	14		10	10	10		13	16	14	
"	d	3	13	8		3	10	6		0	0	0	
Midland Cos.	a	35	61	48	81	33	57	45	79	45	38	41	84
"	b	39	26	33		40	27	34		42	45	43	
"	c	16	10	13		24	6	15		10	13	13	
"	d	10	3	6		3	10	6		3	6	4	
England, S.	a	42	45	44	84	47	60	54	87	58	55	57	91
"	b	42	39	40		43	24	33		32	36	34	
"	c	10	10	10		7	13	10		10	3	6	
"	d	6	6	6		3	3	3		0	6	3	
Scotland, W.	a	35	42	39	74	47	50	49	84	61	52	57	84
"	b	42	29	35		30	40	35		29	26	27	
"	c	10	6	8		17	10	13		7	9	8	
"	d	13	23	18		6	0	3		3	13	8	
England, N.W.	a	35	32	34	76	50	37	44	82	45	58	52	79
"	b	45	39	42		30	47	38		39	16	27	
"	c	10	23	16		17	13	15		16	13	15	
"	d	10	6	8		3	3	3		0	13	6	
England, S.W.	a	48	55	52	87	33	47	40	85	68	45	57	85
"	b	39	32	35		50	40	45		20	36	28	
"	c	10	10	10		7	13	10		6	13	9	
"	d	3	3	3		10	0	5		6	6	6	
Ireland, N.	a	19	45	32	77	43	60	52	82	26	52	39	78
"	b	55	35	45		37	23	30		52	26	39	
"	c	10	10	10		17	10	13		19	13	16	
"	d	16	10	13		3	7	5		3	9	6	
Ireland, S.	a	32	58	45	83	43	64	54	79	23	52	38	85
"	b	49	26	38		37	13	25		58	36	47	
"	c	13	3	8		7	13	10		13	6	9	
"	d	6	13	9		13	10	11		6	6	6	

Summary.

British Isles	a	37	51	44	81	43	53	48	83	50	54	52	85
"	b	42	31	37		39	32	35		37	29	33	
"	c	12	9	10		13	10	12		11	9	10	
"	d	9	9	9		6	5	5		2	8	5	

Districts.		January 1886. Percentages. Wind.	Weather.	Average.	a+b.	February 1886. Percentages. Wind.	Weather.	Average.	a+b.	March 1886. Percentages. Wind.	Weather.	Average.	a+b.
Scotland, N.	a	35	77	56		54	57	56		53	68	63	
"	b	29	23	26	82	29	32	30	86	36	26	31	94
"	c	23	0	12		14	7	11		6	3	5	
"	d	13	0	6		3	4	3		0	3	1	
Scotland, E.	a	42	45	44		54	46	50		42	65	54	
"	b	26	45	35	79	21	39	30	80	42	23	32	86
"	c	19	7	13		25	4	15		13	6	10	
"	d	13	3	8		0	11	5		3	6	4	
England, N.E.	a	55	61	58		72	46	59		42	55	49	
"	b	32	29	31	89	14	45	29	88	35	26	30	79
"	c	7	7	7		14	7	10		23	13	18	
"	d	6	3	4		0	4	2		0	6	3	
England, E.	a	32	45	39		64	71	68		49	45	47	
"	b	42	39	40	79	18	18	18	86	42	32	37	84
"	c	16	10	13		18	7	12		6	13	10	
"	d	10	6	8		0	4	2		3	10	6	
Midland Cos.	a	32	55	44		68	54	61		39	49	44	
"	b	42	42	42	86	11	39	25	86	39	29	34	78
"	c	16	0	8		21	7	14		16	16	16	
"	d	10	3	6		0	0	0		6	6	6	
England, S.	a	65	58	62		57	57	57		61	47	54	
"	b	23	29	26	88	22	36	29	86	23	33	28	82
"	c	6	7	6		21	7	14		13	13	13	
"	d	6	6	6		0	0	0		3	7	5	
Scotland, W.	a	42	55	49		50	47	49		45	43	47	
"	b	26	23	24	73	25	25	25	74	36	26	31	78
"	c	26	9	18		18	14	16		19	13	16	
"	d	6	13	9		7	14	10		0	13	6	
England, N.W.	a	39	61	50		46	50	48		49	61	55	
"	b	32	23	28	78	29	22	26	74	29	20	25	80
"	c	23	6	14		18	7	13		19	0	9	
"	d	6	10	8		7	21	14		3	19	11	
England, S.W.	a	40	65	53		37	57	47		55	42	49	
"	b	33	22	27	80	33	21	27	74	26	26	26	75
"	c	20	13	17		11	4	8		19	16	17	
"	d	7	0	3		19	18	18		0	16	8	
Ireland, N.	a	32	61	47		39	43	41		52	55	54	
"	b	35	16	25	72	36	32	34	75	36	26	31	85
"	c	23	16	20		4	11	8		6	6	6	
"	d	10	7	8		21	14	17		6	13	9	
Ireland, S.	a	52	52	52		22	36	29		47	60	54	
"	b	23	22	23	75	32	32	32	61	40	20	30	84
"	c	19	13	16		21	14	18		3	17	10	
"	d	6	13	9		25	18	21		10	3	6	

Summary.

British Isles	a	43	58	51		51	51	51		49	54	52	
"	b	31	28	29	80	25	31	28	79	35	26	30	82
"	c	18	8	13		17	8	13		13	11	12	
"	d	8	6	7		7	10	8		3	9	6	

APPENDIX XII.

LIST of STATIONS from which DAILY SIMULTANEOUS OBSERVATIONS (at 0h. 8m. p.m. G. M. T.) have been received in 1885.

Stations.	Observers.	Remarks.
	ENGLAND AND WALES.	
Bolton	Rev. T. Mackereth, F.R.A.S.	—
Bradford	J. McLandsborough, F.R.A.S., F.R. Met. Soc., and A. E. Preston.	—
Chatham, School of Military Engineering.	The Instructor in Surveying, R.E.	—
Falmouth Observatory	The Staff.	—
Greenwich Observatory	The Staff, for the Astronomer Royal.	—
Guernsey	A. Collenette, F.R. Met. Soc.	—
Kew Observatory	The Staff.	—
Leicester (Museum)	J. C. Smith.	—
Liverpool Observatory (Bidston).	J. Hartnup, F.R. Met. Soc.	—
Oxford, Radcliffe Obs.	The Staff.	—
Plymouth	J. Merrifield, LL.D., F.R.A.S.	—
Silloth	Rev. F. Redford, M.A., F.R.S.E., since deceased.	Ceased in June 1885.
Stonyhurst Observatory	The Staff.	—
	SCOTLAND.	
Aberdeen Observatory	The Staff.	—
Orkney, Sandwick Manse	Rev. J. R. Anderson.	—
	IRELAND.	
Galway, Queen's College	W. Ryan.	—
Valencia Observatory	The Staff.	—
	BRITISH COLONIES, POSSESSIONS, &c.	
Adelaide	Clement L. Wragge, F.R. Met. Soc.	—
Barbados, W. I.	Surgeon-Maj. in charge.	—
Gibraltar	Surgeon-Gen. in charge.	—
Malta	Surgeon-Major in charge.	—
Nassau (Bahamas)	C. L. Dunscombe.	—
Natal	Surgeon-Maj. in charge.	—
Scutari, British Cemetery	Serg. W. H. Lyne, R.E.	—
Sierra Leone	Surgeon-Maj. in charge.	—

SUMMARY.

—	—
England and Wales	13
Scotland	2
Ireland	2
British Colonies and Possessions	8
Total	25

APPENDIX XIII.

METHODS FOLLOWED IN DEALING WITH METEOROLOGICAL RETURNS FROM LAND STATIONS IN THE BRITISH ISLES.

These stations are of five classes, as stated on page 17.

I.—*Observatories continuously observing all the Meteorological Elements.*

Returns from observatories.

Hourly measurements of the curves obtained from the self-recording instruments at the observatories of the Office are made by the observers at each station, on printed forms supplied for the purpose, which, together with the curves, are forwarded to the Office weekly. They comprise measurements of the barograms, of the dry-bulb and wet-bulb thermograms, of the anemograms, and of Beckley's rain-gauge curves.

Examination of returns.

The measurements are subjected to a careful examination in order to ensure as far as possible their accuracy, and the regulations which have been adopted to secure this end will be found fully detailed in the Report of the Office for 1868. They comprise rules for the guidance of observers, as well as of the assistants charged with the examination of the work at the Office. Attention need be called here to only two of these rules, viz.: (*a*) the use of subsidiary sheets on which are entered the results of a second set of measurements of the curves, made after, and quite independently of, the first set and with a different scale, the two sets of measurements being afterwards compared together, and any differences found inquired into and set right; and (*b*) the re-measurements made by the assistants at the Meteorological Office, and which always amount to 40, and in doubtful cases to many more, per month, for each element.

Results of examination and report to Council.

The attention of the observers is always drawn to such errors as may be detected, and to any failures in the continuity of the curves arising from failure of the light, stoppage of the clock, defective photography, faulty action of the wet-bulb thermometer, &c.; a report containirg the results of the examination of each Observatory being also submitted to the Council each month and printed in their Minutes. The curves and tabulations are eventually bound and stored in the Office.

General supervision of observatory work.

In connexion with this work should be mentioned the general watch which has to be kept over the working of the observatories and of the instruments, not only to secure uniformity amongst them and observance of rules, but also to guard against small changes which are liable to occur at certain times, especially with the thermographs, and which may affect the scale-values of the instrument or the datum lines used for the tabulation of the curves. About twice a year this work calls for special examination, entailing some considerable time and occasionally the engraving of new scales for measuring the curves.

Harmonic analyser.

The photographic curves are also used in the harmonic analyser; for this purpose they require very little preparation.

METHOD OF DEALING WITH THE NUMERICAL RESULTS FROM THE SELF-RECORDING OBSERVATORIES.

Interpolations.

In dealing with the tabulations the first step is to go over the sheets and fill up by interpolation, wherever possible, any gaps or breaks in the continuity of the record.

Means.

The record having been made as complete as possible, the daily, five-daily, and monthly means of the barometer and of the dry-bulb and wet-bulb thermometers are deduced.

Vapour tension. The hourly vapour tension is then computed by an expansion of Glaisher's Hygrometrical Tables, prepared in the Office, and the work is independently checked.

Hourly Readings. A copy is next prepared of the above-mentioned hourly measurements of the barometer, dry-bulb and wet-bulb thermometers, wind and rain curves, and of the computed hourly values of vapour tension. To these are added the daily means of the three first-mentioned elements, the extremes and daily range of pressure and temperature, and the daily totals of rainfall, and the whole series is printed and published under the title of "Hourly Readings from the Self-recording Instruments "at the Four Observatories under the Meteorological Council."

To ensure accuracy the sheets are read over in proof with the originals. The interpolated readings are printed in *italic* type, but no distinguishing mark is affixed to means which are partly based on them. When the gap in the record is too long to be dealt with by an interpolation of the missing hourly readings, the mean for the day is obtained by an interpolation from the adjacent daily means, and the result thus obtained is printed as an approximation.

Monthly and Annual Tables. The five-daily, monthly, and annual means, together with the absolute extremes of pressure and temperature for each month, were formerly published as an appendix to the Quarterly Weather Report, but, beginning with the volume for 1881, they have been printed instead at the end of the "Hourly Readings." As before the tables are repeated in French measures.

Gale tables. The gale tables printed in the text of the Quarterly Weather Report, which show the extent, duration, and degree of severity of all the stronger gales, are prepared from the tabulations of the anemograms received from the self-recording observatories, together with those received from the extra anemographic stations.

II.—*Anemographic Stations at which the Wind is recorded continuously.*

The anemograms received from the stations enumerated on page 85 are regularly examined and tabulated in the Office, and the sheets bound up in volumes. Besides special inquiries on legal and other points that from time to time arise, and in which these documents are of the highest importance, the tabulations are always employed in the preparation of the chronicle and gale tables for the Quarterly Weather Report. They are also regularly used in the checking of the storm warnings issued by the Office.

III.—*Method followed with regard to the Returns from Land Stations of the Second Order.*

Origin and progress of system. Ever since the year 1866 returns of more or less completeness have been received from land stations in the United Kingdom. In that year there was only one station, but by 1871 the number had increased to 15, and five years later to 49, including 14 stations belonging to the Royal Meteorological Society, copies of the returns from which were sent to the Office under a special arrangement with the Society.

At the end of the present year the total number of stations was 69, including 15 belonging to the Royal Meteorological Society and 5 belonging to the Scottish Meteorological Society.

This number is exclusive of the self-recording observatories, and of the anemographic stations, but it includes several from which only very scanty information is received.

The stations are distributed as follows: 40 in England, 3 in Wales 10 in Scotland, and 16 in Ireland.

The returns are received at the Office monthly, and are duly entered and stored.

The publication of the returns is carried out in the following way: For a certain number of stations the observations of pressure, temperature, wind, cloud amount, and weather, at 9 a.m. and 9 p.m. each day, together with the computed vapour tension and relative humidity at those hours, and the daily maxima and minima of temperature, and daily rainfall, are published *in extenso* on the Form, A., proposed by the Permanent Committee of the First International Meteorological Congress at Vienna in 1874, and adopted for international use by the Second International Meteorological Congress at Rome in 1879. Publication on Form A.

The Permanent Committee assigned an inferior limit to the number of stations from which returns should be published *in extenso*, varying from two for Belgium to 100 for Russia in Asia, the number in the case of the United Kingdom being 15. In 1875, when the systematic publication of returns from Stations of the Second Order began, only nine British stations were available, but this number has steadily grown, until for 1880 returns from 33 stations were published on the A. Form. Though this list could be extended if desired, it has been thought better to curtail it somewhat on account of the size of the publication. The volume for 1882, now passing through the press, will therefore, like that for 1881, contain returns, *in extenso*, from only 30 stations.

Care is taken in adding to the list for publication to see, first, that the station is satisfactory as regards its instruments, their exposure, &c.; secondly, that the returns bear internal evidence of accuracy and care in their preparation; and thirdly, that the district represented by the station is one for which information is needed. Additions to the list for publication.

Full particulars as to the methods adopted in the examination of the returns will be found in previous reports. Examination.

Besides this publication in full, the monthly means of the various elements, together with summaries of the wind direction and of the weather, are published on the Form, B., also devised by the Permanent Committee of the Vienna Congress, and adopted by the Roman Congress. Publication on Form B.

Returns from six stations were published in this manner for the year 1873, and from nine stations for the year 1874. In 1875 the list included the names of 26 stations. This number has grown to 45 for the year 1882, and might be even further increased.

All the stations, returns from which are published *in extenso* on Form A., are included in the Form B. list. But this list also includes others, either not quite so good, not so representative, or not so long established. The method of preparation is in the main the same as in the case of the Form A. But the summaries of wind and weather are specially prepared for this publication. For wind, the summary shows the number of *observations* at 9 a.m. and 9 p.m. under each of the bi-quadrantal points N., N.E., E., &c., the observations under intermediate points being thrown alternately forward and backward. For weather, the summary gives the number of *days* of rain, snow, hail, thunderstorm, clear sky, overcast, and gale. The days of clear sky and overcast are those when the mean of the cloud amounts at 9 a.m. and 9 p.m. are less than 2, and more than 8 respectively. The days of gale are those when force 7 or upwards, by Beaufort scale, is recorded.

The monthly rainfall values (total, number of rainy days, and maximum) for the observatories and all the Stations of the Second Order are supplied each year to Mr. Symons, F.R.S., for publication in his "British Rainfall." British rainfall.

The observations are taken at 9 a.m. and 9 p.m. local time each day. It sometimes happens, however, that strict punctuality cannot be observed. In such cases, if the difference in time does not exceed 30 minutes, the Unpunctual observations.

observations are, in most cases, printed without alteration. When the difference exceeds 15 minutes, a note is inserted in the remarks showing the exact time of observation. If the difference in time is more than half-an-hour, the readings are usually rejected and an interpolation made.

New stations. When an application for the adoption of a new station is received, a schedule is forwarded to the observer containing a series of questions as to the outfit of the station, the exposure of the instruments, and the influence likely to be exerted on their indications by surrounding objects, such as houses and trees. Only mercurial barometers are accepted, and only such as have been duly verified. All thermometers must have been tested at Kew. A plan of the station, showing the positions of the instruments with regard to neighbouring objects is also required.

On the return of this schedule the answers are considered, and, where necessary, alterations are advised.

If, however, the existing arrangements are satisfactory, tables for reducing the barometer readings to 32° Fahrenheit at mean sea level are prepared and duplicates sent to the observer, together with a set of Hygrometrical Tables, and a copy of "Instructions in the Use of Meteorological Instruments."

The first returns are compared and examined with special care, and a report of the result of the examination is forwarded to the observer, with instructions how best to complete and perfect the returns.

Sunshine records. The daily records of sunshine which are now received from 35 Stations in the British Islands are examined generally to guard against accidental changes in the adjustment of the instrument. After their receipt has been acknowledged, the cards are duly stamped and dated and then stored in the Office.

Weekly totals. A tabulation of these curves is published as part of the Weekly Weather Report, mentioned in Appendix VII., and for those stations which are also Stations of the Second Order the monthly totals of bright sunshine in hours, together with the percentage of its possible duration, is published as Part IV. of "Returns from Stations of the Second Order." A table showing the daily amount of sunshine at Bunhill Row, one of the London stations, is also prepared quarterly for the Royal Meteorological Society.

Inspection.

The Stations of the Second Order are regularly inspected, the attention of the inspector being directed by the Office to any special point which may require investigation.

IV.—*Telegraphic Reporting Stations.*

Full particulars relating to these stations, the information received from them, and the method of dealing with that information, will be found in Appendix VII. A paragraph in that Appendix (p. 63) explains the use that is made of the monthly schedules sent in by the observers.

V.—*Extra Stations.*

No returns from Stations of the Fifth Class are published by the Office, but some of them are regularly used in the checking of the storm-warnings, and all are available for any special investigation that may be taken up.

The rainfall values at these stations are, however, copied and supplied to Mr. Symons, F.R.S., for publication in "British Rainfall."

APPENDIX XIV.

List of Documents relating to the Land Meteorology of the British Islands, received during the Year ending March 31st, 1886.

	Stations.	Observers.	Nature of Information received.	Notes.
I.	†Valencia	J. E. Cullum		
	†Glasgow	Prof. R. Grant, M.A., LL.D., F.R.S.		From January 1886.
	†Aberdeen	Prof. C. Niven, M.A., F.R.S.	Continuous records of pressure, temperature, wind, sunshine, and rain, with notes on the weather.	
	†Falmouth	E. Kitto, F.R. Met. Soc.		
	†Stonyhurst	Rev. S. J. Perry, M.A., F.R.S.		
	†Kew	G. M. Whipple, B.Sc., F.R.A.S., F.R. Met. Soc.		
II.	Armagh	J. L. E. Dreyer, Ph.D., F.R.A.S.	Continuous record of wind, rainfall, and sunshine.	
	Alnwick Castle	Lt.-Col. F. Holland, for the Duke of Northumberland, K.G.	Continuous record of wind (direction and velocity).	
	†Holyhead	Hugh Williams, C.E.	" "	
	†Sandwick	Miss Clouston and the Rev. J. R. Anderson	" "	Till December 1885.
	†Swanbister	W. I. Fortescue, Esq.	" "	From December 1885.
	†Scilly	W. Thomas	" "	
	†Yarmouth	G. T. Watson	" "	
	†Kilkenny Castle	The Marquis of Ormonde	Continuous record of pressure.	
	Waterford	The Harbour Authorities	" "	
III.	Armagh	J. L. E. Dreyer, Ph.D., F.R.A.S.		
	Aysgarth	Rev. Fenwick W. Stow, M.A., F.R. Met. Soc.		
	Babbacombe	E. E. Glyde, F.R. Met. Soc.		
	Braemar	James Aitken, J.P.	Regular observations at 9 a.m. and 9 p.m. of pressure, temperature, wind, cloud and weather, with the daily maxima and minima of temperature, the daily rainfall, and general remarks on the weather.	
	Buxton	E. J. Sykes, M.B., F.R.A.S., F.R. Met. Soc.		
	Carmarthen	G. J. Hearder, M.D.		
	Chatham	W. Skipper and P. McHugo for Instructor in Surveying.		
	Cheadle	J. C. Philips, Esq.		
	Cheltenham	R. Tyrer, B.A., F.R. Met. Soc.		
	Churchstoke	Philip Wright, F.C.S., F.R. Met. Soc.		

LIST OF DOCUMENTS—*continued.*

Stations.	Observers.	Nature of Information received.	Notes.
†Brookeborough -	W. Ferguson, for Sir Victor Brooke, Bt., F.L.S.	Regular observations at 9 a.m. and 9 p.m. of pressure, temperature, wind, cloud and weather, with the daily maxima and minima of temperature, the daily rainfall, and general remarks on the weather.	Mr. Vibert died March 1886.
Cronkbourne, Isle of Man.	A. W. Moore, M.A., J.P. - - -		
†Dublin (Botanic Gardens, Glasnevin).	F. W. Moore, Esq., F.L.S. - - -		
†Dublin (City) -	J. W. Moore, M.D., F.R. Met. Soc. - -		
†Dublin (Mountjoy Observatory).	Col. Sir C. W. Wilson, R.E., K.C.B., F.R.S., Ordnance Survey Office.		
⚓†Dundee - -	W. Ross McKelvie, Esq. - - -		
⚓†Dunrobin Castle -	D. Melville - - - - -		
†Durham - -	H. J. Carpenter, Esq. - - - -		
Geldeston (Beccles) -	E. T. Dowson, F.R. Met. Soc. - -		
†Glenalmond - -	Arthur S. Reid, M.A., F.G.S. - -		
Hillington - -	Rev. H. E. B. Ffolkes, M.A., F.R. Met. Soc. -		
†Jersey (St. Aubin's) -	J. E. Vibert, M.A. - - - -		
Killarney - -	Ven. Archdeacon Wynne, M.A., F.R. Met. Soc.		
†Laudale (Argyleshire)	A. Fletcher, for T. H. G. Newton, M.A., J.P., F.R. Met. Soc.		
Llandudno - -	J. Nicol, M.D., J.P., F.R. Met. Soc. - -		
†Leicester - -	J. C. Smith, for Museum Authorities - -		
†Londonderry - -	J. Conroy, F.R. Met. Soc. - - -		
Margate - -	J. Stokes, F.R. Met. Soc. - - -		
†Markree Castle, Sligo	A. Marth, F.R.A.S., for Col. Cooper, F.R.A.S.		
Marlborough - -	Rev. T. A. Preston, M.A., F.R. Met. Soc. -		
Newton Reigny (Penrith).	T. G. Benn, F.R. Met. Soc. - - -		
†Parsonstown - -	W. Harding, for the Earl of Rosse, F.R.S. -		
⚓†Pinmore - -	Peter Donald - - - - -		

LIST OF DOCUMENTS—*continued.*

Stations.	Observers.	Nature of Information received.	Notes.
† Prestwich - -	T. R. H. Clunn, M.D., F.R. Met. Soc. -	Regular observations at 9 a.m. and 9 p.m. of pressure, temperature, wind, cloud and weather, with the daily maxima and minima of temperature, the daily rainfall, and general remarks on the weather.	
† Rothesay - -	James Kay, Esq. - - - -		
† Sandwick - -	Miss Clouston and Rev. J. R. Anderson -	- - - - - -	Till November 1885.
Scaleby - -	R. A. Allison, M.P., F.R. Met. Soc. - -		
Scarborough - -	Allan Rowntree, F.R. Met. Soc. - -		
† Seaham - -	G. H. Aird - - - - -		
† Southampton -	J. T. Cook, R.E., for Director General of the Ordnance Survey.		
Southbourne - -	T. A. Compton, B.A., M.D., F.R. Met. Soc. -		
Stokesay - -	Miss M. A. Digges La Touche - -		
† Stonyhurst - -	Rev. S. J. Perry, F.R.S. - - -		
St. David's, Pembroke	W. P. Propert, LL.D., F.G.S., F.R. Met. Soc.		
† St. Leonards -	H. Colborne, M.R.C.S. - - -		
† Swanbister - -	W. I. Fortescue - - - -	- - - - - -	From January 1886.
† Totnes - -	T. H. Edmunds, Esq. - - - -	- - - - - -	Till December 1885.
† Uppingham - -	Rev. G. H. Mullins, M.A., F.R. Met. Soc. -		
Wakefield - -	H. Clarke, L.R.C.P., F.S.S., F.R. Met. Soc. -		
Ware, Herts - -	Rev. B. Ward - - - - - -	- - - - - -	Till May 1885.
Whitby (Lighthouse) -	E. J. W. Powell - - - -	- - - - - -	From January 1886.
† York - -	H. M. Platnauer, F.G.S. - - -		
IV. The Telegraphic Stations, see List on p. 45 - - - -		Regular observations twice (and in some cases three times) daily of pressure, temperature, wind, weather, and sea disturbance.	
V. † Arlington Court, Devon	J. Carter, for Lady Chichester - -	Pressure, temperature (dry-bulb, wet-bulb, max., min.), wind and rainfall, once daily.	
Baltimore - -	J. Halsey - - - - -	Pressure, temperature, wind, and weather, once daily.	
Castletownsend -	Lieut. T. W. Cobb, R.N. - - -	Pressure and temperature four times daily, and wind twice daily.	
Crookhaven - -	„ „ - - - -		

LIST OF DOCUMENTS—*continued.*

Stations.	Observers.	Nature of Information received.	Notes.
Crosshaven	J. W. Bridle	Pressure, temperature, and wind, twice daily.	
Cooper's Hill (Egham)	Prof. H. McLeod, F.R.S.	Full return for 9 a.m. and 3 p.m.	
Delph, Yorkshire	W. K. Inglis	Pressure, wind, and weather twice daily, with max. and min. temperatures, and rainfall.	From January 1886.
Ennis	J. Hill, C.E., F.R. Met. Soc.	Daily rainfall.	
Gorleston, Norfolk	R. C. J. Day	Pressure and wind twice daily.	
Harpenden	T. Wilson, F.R. Met. Soc.	Pressure, temperature, and wind, twice daily, with rainfall.	
Haslar	G. Coppen	Pressure and temperature four times daily.	
Rugby	C. H. Hodges, M.A.	Full set of 9 a.m. observations with 9 p.m. temperatures.	
Saffron Walden	J. G. Bellingham	Pressure and temperature twice daily, with 9 a.m. wind and rainfall.	
Schull	Lieut. T. W. Cobb, R.N.	Pressure, temperature, and wind twice daily.	
†Sheffield (Weston Park)	Elijah Howarth, F.R.A.S.	Full returns for 9 a.m. and 6 p.m.	
Stamford (Ketton Hall)	Fred. Coventry, F.R. Met. Soc.	Full monthly summary.	
Sudbury	W. Bayley Ransom	Pressure, temperature (dry-bulb, max., min.), wind, cloud, and rainfall, once daily, with general remarks.	
Symbister, Whalsey, Shetland.	J. Bruce, Esq.	Pressure and temperature twice daily.	
Tarbert (Harris)	Donald Bethune	Pressure and wind twice daily.	
Union Hall	Lieut. T. W. Cobb, R.N.	Pressure, temperature, and wind, twice daily.	

NOTE.—The Stations marked "℞" belong to the Royal Meteorological Society; those marked "℘" belong to the Scottish Meteorological Society; those marked thus † have been inspected during the year.

CONTINUOUS RECORDS of BRIGHT SUNSHINE have also been received from the following Stations, in addition to those already mentioned on p. 85.

Station.	Observer.
Blackpool	C. T. Ward, M.A., F.R. Met. Soc.
Cambridge	H. Todd.
Churchstoke	P. Wright, F.C.S., F.R. Met. Soc.
Cirencester	Prof. Ohm., B.A., F.R. Met. Soc.
Cronkbourne, Isle of Man	A. W. Moore, M.A., J.P.
Cullompton	Thos. Turner, J.P., F.R. Met. Soc.
Dublin	Sir C. Wilson, Col. R.E., K.C.B., F.R.S.
Durham	H. J. Carpenter.
Geldeston	E. T. Dowson, F.R. Met. Soc.
Hastings	H. Colborne, M.R.C.S.
Hillington	Rev. H. E. B. Ffolkes, M.A., F.R. Met. Soc.
Jersey	J. Fisher.
Leicester	J. C. Smith.
Llandudno	J. Nicol, M.D., J.P., F.R. Met. Soc.
London, Bunhill Row	Messrs. de La Rue.
„ Westminster	The Staff, Meteorological Office.
Markree Castle	A. Marth, F.R.A.S. for, Col. E. H. Cooper.
Oxford	E. J. Stone, F.R.S.
Oswald Kirk, Yorkshire	R. Thompson.
Parsonstown	Dr. Boeddicker, for the Earl of Rosse, F.R.S.
Penrith	T. G. Benn, F.R. Met. Soc.
Plymouth	J. Merrifield, L.L.D., F.R.A.S.
St. Ann's Head	Messrs. Blake & Spicer.
Southampton	R. H. Stotherd, Col. R.E., C.B.
Stornoway	D. Macdonald.
Swanbister (Orkney)	W. Irvine Fortescue.
Worksop	H. Mellish, F.R. Met. Soc.
York	J. E. Clarke, B.A., B.Sc.

APPENDIX XV.

ACCESSIONS TO THE LIBRARY DURING THE YEAR ENDING 31ST MARCH 1886.

A—AGRICULTURE AND BOTANY.

Commissioner of Agriculture, Washington.—Report . . . for the year 1884. 581 pp., 71 plates, la. 8°. Washington, 1884.

‖ **Hamberg, H. E.**—Om skogarnes inflytande på Sveriges klimat. (De l'influence des forêts sur le climat de la Suède.) I. & II. 76 pp., 1 plate, la. 4°. Stockholm, 1885. (*Bihang till Domänstyrelsens underdåniga berättelse rörande skogsvårdsemlet för år*, 1884.)

In the French language also.

Ufficio centrale di Meteorologia, Roma.—Rivista Meteorico-Agraria. Anno VI., 1885, Nos. 1–36. la. 8°. (Roma, 1885–86.)

‖ **Wollny, E.**—Beiträge zur Frage der Schwankungen im Kohlensäuregehalt der atmosphärischen Luft. 19 pp. 8°. (*Forschungen auf dem Geb. Agrik.-phys., Heidelberg. Bd.* viii., *Heft* 5.)

‖ ———.—Untersuchungen über den Einfluss des Bodens und der landwirthschaftlichen Kulturen auf die Temperatur- und Feuchtigkeitsverhältnisse der atmosphärischen Luft. 28 pp. 8°. (*Forschungen auf dem Geb. Agrik.-phys., Heidelberg. Bd.* viii., *Heft.* 3/4.)

B—ASTRONOMY.

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X—WEATHER TELEGRAPHY AND PREDICTION.

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|| **Harries, H.**—The typhoon origin of the weather over the British Isles during the second half of October 1882. 11 pp., 1 plate, la. 8°. (*Quart. Journ. R. Meteor. Soc.*, xii., 1886, *p.* 10.)

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‖ ———.—On some micro-organisms from Rainwater-ice, and hail. Read 10th May 1882. 11 pp. 8°. (London, s.a.) (*Journ. R. Microsc. Soc., Ser.* 2, *vol.* ii., *p.* 449.)

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* **Miquel, P.**—Les organismes vivants de l'atmosphère. viii. + 310 pp., 2 plates, la. 8°. Paris, 1883.

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* ———.—Chart of the Gulf of Aden, surveyed by Capt. Haines, Lieuts. Barker and Grieve. Sheet 2nd, 1847. Corrections, Sept. 1868, Oct. 1885. 1 chart, la. f°. (London), 1853.

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Contains some meteorological observations, British and Foreign.

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APPENDIX XVI.

METEOROLOGICAL OFFICE: ACCOUNT of RECEIPTS and PAYMENTS for the year ending 31st March 1886.

RECEIPTS.

	£ s. d.	£ s. d.
Balance from year 1884–85		1,743 4 10
Parliamentary Vote		15,300 0 0
Repayment of expenses charged under—		
(1.) Incidental expenses	24 1 3	
(2.) Special researches	33 0 2	
		57 1 5
SUPPLY OF INFORMATION:—		
D.W. Charts and Forecasts	276 0 9	
6 p.m. Charts	31 5 0	
Information for Press Agencies, &c.	86 3 8	
Telegrams	298 12 5	
Miscellaneous data	16 1 0	
		708 2 10
SALE OF INSTRUMENTS, &c.:		
Royal Navy (A)	4 17 6	
Mercantile Marine account (B)	65 0 2	
		69 17 8
Commissions executed for Colonial and Foreign Institutions, &c. (C)		143 3 5
Commission charged on work done for Colonies, &c.		29 4 7
		£18,050 14 9

PAYMENTS.

	£ s. d.	£ s. d.
ADMINISTRATION:		
Payment of Council	1,000 0 0	
Secretary	800 0 0	
Salaries and wages	769 19 0	
Rent, fuel, and lighting	719 5 10	
Incidental and contingent expenses:—		
Attendance, cleaning, &c.	382 0 0	
Furniture and fittings	74 4 4	
Expenses incidental to International Meteorological Congress	17 18 4	
Pensions	42 16 4	
		3,805 18 10
SPECIAL RESEARCHES		765 17 1
LAND METEOROLOGY:		
Observatories and stations	1,817 6 5	
Salaries: — Discussion and reduction of observations	1,318 5 1	
		3,135 11 6
WEATHER INFORMATION AND FORECASTS:		
Telegraphic reports and storm warnings	3,003 6 3	
Salaries:—Preparation and issue of reports and forecasts	1,583 18 9	
		4,587 5 0
INSPECTIONS:		
Salaries and travelling expenses	552 18 1	
Less repayment of advance	3 8 4	
		549 9 9
OCEAN METEOROLOGY:		
Salaries: — Discussion and reduction of observations	1,823 15 0	
Expenses incidental to the supply of instruments:—		
Proportion for care and issue of instruments	200 0 0	
Royal Navy	376 1 3	
Mercantile Marine	409 7 7	
Distant island and coast stations	20 5 0	
		2,829 8 10
Commissions executed for Colonial and Foreign Institutions, &c.		112 3 1
BALANCE:		
Cash at Bank	2,141 18 0	
„ at Office	73 7 8	
Advance to Valencia Observatory	50 0 0	
		2,265 0 8
		£18,050 14 9

APPENDIX XVII.

LIST OF PUBLICATIONS, &c. issued under the Authority of the Meteorological Council.

OFFICIAL.

No. 1. Report for 1867. Presented to Parliament. 1*s.*

2. Instructions for Meteorological Telegraphy. New Edition. (1875.) 6*d.*

3. Fishery Barometer Manual. 6*d.*

4. Charts of Surface Temperature, South Atlantic Ocean. 2*s.* 6*d.*

5. Report for 1868. Presented to Parliament. 5*d.*

6. Report for 1869. Presented to Parliament. 10*d.*

7. Quarterly Weather Report for 1869.—Parts I. to IV. 5*s.* each.

8. The Barometer Manual (out of print, see Nos. 24, 40, 60, and 61).

9. Quarterly Weather Report for 1870.—Parts I. to IV. 5*s.* each.

10. Report for 1870. Presented to Parliament. 10*d.*

11. Contributions to our Knowledge of the Meteorology of Cape Horn and the West Coast of South America. 2*s.* 6*d.*

12. Currents and Surface Temperature of the North Atlantic Ocean, from the Equator to Lat. 40° N., for each month of the year, with a General Current Chart. 2*s.* 6*d.*

13. A Discussion of the Meteorology of the Part of the Atlantic lying North of 30° N., for the Eleven Days ending 8th February 1870. Price, with Book of Charts, 5*s.*

14. Quarterly Weather Report for 1871.—Parts I. to IV. 5*s.* each.

15. Report for 1871. Presented to Parliament. 10*d.*

16. Quarterly Weather Report for 1872.—Parts I. to IV. 5*s.* each.

17. Report for 1872. Presented to Parliament. 1*s.*

18. Contributions to our Knowledge of the Meteorology of the Antarctic Regions. 2*s.*

19. Quarterly Weather Report, 1873.—Parts I. to IV. 5*s.* each.

20. Charts of Meteorological Data for Square 3. Lat. 0°—10° N. Long. 20° — 30° W., and Remarks to accompany the Monthly Charts, which show the Best Routes across the Equator for each Month, &c. 20*s.*

21. Report of the Proceedings of the Meteorological Congress at Vienna. 1*s.*

22. Report for 1873. Presented to Parliament. 4*d.*

LIST OF PUBLICATIONS, &c.—*continued.*

No. 23. Report of the Proceedings of the Conference on Maritime Meteorology held in London, 1874. 2*s.*

24. Instructions in the Use of Meteorological Instruments. [Reprinted 1885. 6*s.*]

25. Quarterly Weather Report for 1874.—Parts I., II., and IV. 5*s.* each. Part III., 5*s.* 9*d.*

26. Report for 1874. Presented to Parliament. 6*d.*

27. Charts of Meteorological Data for the Nine 10° Squares of the Atlantic which lie between 20° N. and 10° S., and extend from 10° to 40° W., with accompanying Remarks ending with the Best Routes across the Equator. 24*s.*

28. Contributions to our Knowledge of the Meteorology of Japan. By Staff-Commander Thomas H. Tizard, H.M.S. *Challenger.* 1*s.*

29. Report for 1875. Presented to Parliament. 4*d.*

30. Quarterly Weather Report for 1875.—Parts I.—IV. 5*s.* each.

31. Report for 1876–7. Presented to Parliament. 3*s.* 5*d.*

32. A Discussion of the Meteorology of the North Atlantic during August 1873, with 31 Synoptic Charts. 15*s.*

33. Quarterly Weather Report for 1876.—Part I., 6*s.*; Parts II.—IV., 5*s.* each.

34. Contributions to our Knowledge of the Meteorology of the Arctic Regions.—Vol. I., Part I., 2*s.*; Part II., 10*s.*; Part III., 6*s.*; Part IV., 5*s.*

35. Report for 1877–8. Presented to Parliament. 1*s.*

36. Report of the Proceedings of the Meteorological Congress at Rome, 1879. 1*s.* 6*d.*

37. Report on the Meteorology of Kerguelen Island. By the Rev. S. J. Perry, S.J., F.R.S. 3*s.*

38. Report for 1878–9. Presented to Parliament. 5*d.*

39. Meteorological Observations at Stations of the Second Order for the year 1878. 20*s.*

40. Aids to the Study and Forecast of Weather, by the Rev. W. Clement Ley, M.A. 1*s.*

41. Report for 1879–80. Presented to Parliament. 1*s.*

42. Report for 1880–81. Presented to Parliament. 1*s.* 2*d.*

43. Charts of Meteorological Data for the Ocean District adjacent to the Cape of Good Hope, with accompanying Remarks. Price of the Charts, 25*s.*; of the Remarks, 7*s.*

44. Report on the Gales experienced in the Ocean District adjacent to the Cape of Good Hope, between Lat. 30° and 50° S., and Long. 10° and 40° E., by Capt. H. Toynbee, F.R.A.S. 7*s.* 6*d.*

45. Meteorological Observations at Stations of the Second Order for the year 1879. 20*s.*

46. Report on the Storm of October 13–14, 1881. By Robert H. Scott, F.R.S. 1*s.* 6*d.*

LIST OF PUBLICATIONS, &c.—*continued.*

No. 47. Rainfall Tables of the British Isles for 1866–80. Compiled by G. J. Symons, F.R.S. 7*s.* 6*d.*

48. Report for 1881–2. Presented to Parliament. 1*s.*

49. Quarterly Weather Report for 1879. (New Series.) Appendices and Plates. 27*s.*

50. Quarterly Weather Report for 1880. (New Series.) Appendices and Plates. 28*s.*

51. Hourly Readings, 1881. (New Series.) Part I., 10*s.* 6*d.* Parts II., III., and IV., 21*s.* each.

52. Quarterly Weather Report for 1877. (New Series.) Appendices and Plates. 27*s.* Part I., 10*s.*; Part II., 5*s.*; Part III., 4*s.* 6*d.*; Part IV., 6*s.*

53. Meteorological Atlas of the British Isles. 5*s.* 6*d.*

54. Hourly Readings, 1882. (New Series.) Parts I. and II. 20*s.* Part III. 22*s.* 6*d.* Part IV. 26*s.*

55. Quarterly Weather Report for 1878. (New Series.) Appendices and Plates. 28*s.* Part I., 6*s.* (Part II., in the Press.)

56. Sunshine Records of the United Kingdom for 1881. 4*s.*

57. Meteorological Observations at Stations of the Second Order for the year 1880. 34*s.* 6*d.*

58. Report for 1882–3. Presented to Parliament. 10½*d.*

59. Sea Temperature Charts for the Atlantic, Indian, and Pacific Oceans. 21*s.*

60. Principles of Forecasting by Means of Weather Charts. By the Hon. Ralph Abercromby, F.R. Met. Soc. (Second edition, revised), 2*s.*

61. The Barometer Manual for the Use of Seamen. 1*s.* 3*d.*

62. Monthly Weather Report, 1884.

63. Hourly Readings, 1883 (New Series). Parts I., II., and III., 21*s.* each. Part IV. Price 30*s.*

64. Report for 1883–4. Presented to Parliament. 1*s.* 2*d.*

65. Monthly Weather Report, 1885.

66. Meteorological Observations at Stations of the Second Order for 1881. Price 35*s.*

67. Report for 1884–5. Presented to Parliament. 4*s.* 4*d.*

68. Monthly Weather Reports for 1886. Jan.–September, 1*s.* 6*d.* each. (October and November in the Press.)

69. Meteorological Observations at Stations of the Second Order for the year 1882. Price 35*s.*

70. Hourly Readings, 1884. Part I. Price 12*s.* (Part II., in the Press.)

71. Synchronous Weather Charts of the North Atlantic and the adjacent Continents. Aug. 1, 1882 to Aug. 31, 1883. Part I. Charts, price 16*s.*; with Portfolio, price 24*s.*

72. Report for 1885–86. 8*d.*

LIST OF PUBLICATIONS, &c.—*continued.*

NON-OFFICIAL.

No. 1. Report to the Committee on the Connexion between Strong Winds and Barometrical Differences.—By Robert H. Scott, Director of the Office. 6*d.*

2. Report to the Committee on the Meteorology of the North Atlantic.—By Captain H. Toynbee, Marine Superintendent. 1*s.*

3. Report to the Committee on the Use of Isobaric Curves.—By Captain H. Toynbee, Marine Superintendent. 1*s.*

4. Routes for Steamers from Aden to the Straits of Sunda and back. Translated from a Paper issued by the Royal Meteorological Institute of the Netherlands. 6*d.*

5. On the Winds, &c. of the North Atlantic along the Tracks of Steamers from the Channel to New York. Translated from a Paper issued by the Deutsche Seewarte, Hamburg. 6*d.*

6. Report of the Proceedings of the Meteorological Conference at Leipzig. 1*s.*

7. Notes on the Form of Cyclones in the Southern Indian Ocean.—By C. Meldrum, Esq., M.A., F.R.S. 6*d.*

8. Report on Weather Telegraphy and Storm Warnings. Presented to the Meteorological Congress at Vienna. 6*d.*

9. Report of the Permanent Committee of the Vienna Congress for 1874. 1*s.* 6*d.*

10. On the Physical Geography of the part of the Atlantic which lies between 20° N. and 10° S., and extends from 10° to 40° W. A Paper read before the British Association at Bristol, in August 1875, by Capt. Toynbee, F.R.A.S., F.R.G.S., Marine Superintendent. 1*s.* 6*d.*

11. Report of the Permanent Committee of the Vienna Congress for 1876. 2*s.*

12. Reports to the Permanent Committee of the Vienna Congress on Atmospheric Electricity, Maritime Meteorology, and Weather Telegraphy, 1878. 2*s.*

13. Report of the Permanent Committee of the Vienna Congress for 1878. 6*d.*

14. Report of the International Meteorological Committee, Meeting at Berne, 1880. 1*s.*

15. Report of the Second Meeting of the International Meteorological Committee, held at Copenhagen, August 1882. 2*s.* 6*d.*

16. Report of the Third Meeting of the International Meteorological Committee, held at Paris, September 1885. 1*s.*

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LONDON: Printed by EYRE and SPOTTISWOODE,
Printers to the Queen's most Excellent Majesty.
For Her Majesty's Stationery Office.

REPORT

OF THE

METEOROLOGICAL COMMITTEE

TO THE

ROYAL SOCIETY,

For the Year ending Six of March 1867.

Presented to both Houses of Parliament by Command of Her Majesty.

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1867.

REPORT

OF THE

Met. 294

METEOROLOGICAL COUNCIL

TO THE

ROYAL SOCIETY,

For the Year ending 31st of March 1887.

Presented to both Houses of Parliament by Command of Her Majesty.

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1888.

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REPORT

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THE METEOROLOGICAL COUNCIL,

1886–87.

Lieutenant-General Richard Strachey, R.E., C.S.I., F.R.S., Chairman.

Professor George Howard Darwin, M.A., LL.D., F.R.S.

Mr. Francis Galton, M.A., F.R.S.

Professor George Gabriel Stokes, LL.D., P.R.S.

Mr. Edward J. Stone, M.A., F.R.S.

Captain William J. L. Wharton, F.R.S., Hydrographer of the Admiralty.

REPORT

OF THE

METEOROLOGICAL COUNCIL

TO THE

ROYAL SOCIETY,

For the Year ending March 31, 1887.

Introductory.

No change has taken place in the Council during the year, and its executive officers continue as before:—

Mr. R. H. Scott, M.A., F.R.S., Secretary.
Captain H. Toynbee, F.R.A.S., Marine Superintendent.
Navigating-Lieutenant C. W. Baillie, F.R.A.S., Assistant do.

The present Report is as usual arranged under three headings:—

I. Ocean Meteorology.
II. Weather Telegraphy.
III. Land Meteorology of the British Isles.

PART I.

Ocean Meteorology.

Collection of information.

Collection of Information.—The practice followed by the Office as regards its dealing with observers at sea has not been changed, and is described in former Reports.

Recognition of "excellent" observers.

Appendix I. (p. 31) contains a list of all the observers who have contributed "excellent" logs during the past year. Some of them have regularly co-operated with the Office for many years; the names which now appear in the list for the first time are as follows:—

Captain's Name.	Ship.
Barrett, T.	"Craigburn."
Baxter, A. S.	"City of York."
*Blackburne, Mr. H. I.	S.S. "Brindisi."
Bright, H.	"Beltana."
Chaddock, G. A.	"Elissa."
Crighton, A. T.	S.S. "Colina."
Crowley, C.	"Lucia."
Dawson, Comr. L. S., R.N.	H.M.S. "Sylvia."
Douglas, Lieut. H. H., R.N.	Do.
Draper, R.	S.S. "Monarch."

* Chief Officer.

Captain's Name.	Ship.
*Evans, Mr. E. J.	S.S. "Tainui."
Gray, H. W.	"Pleione."
King, J. W.	"Philomene."
*Lancaster, Mr. C.	S.S. "Germanic."
Machugh, R. H.	S.S. "Ching-Wo."
Smith, Sub.-Lieut. F. Bowden, R.N.	H.M.S. "Myrmidon."
Trunks, H.	"Aldborough."
West, F.	S.S. "Port Adelaide."
Williams, H.	"Dynomene."

The Council regret to have to record the death of Captain T. Barrett, Mr. R. Ladd, F.R.A.S., and Captain J. Smith, who were "excellent" observers.

Proportion of "excellent" to total number of logs received.

The following is the total number of logs received from April 1, 1886, to March 31, 1887, and the number of logs which have been classed as "excellent":—

Total No. of Logs received.	No. of Excellent Logs.	Per-centage of Excellent Logs.
182	129	70

The average number of logs received annually during the five years, 1881–85, was 170, and the per-centage of excellent logs among these was 73.

The Council take this opportunity of expressing their best thanks to the observers who have assisted them during the past year.

Districts from which observations are obtained.

On the 31st of March 1887 the ships observing for the Office were pursuing the following voyages:—

To Baffin's Bay or Greenland	5
„ North America, East Coast	9
„ „ „ West „	9
Off East Coast of North America	4
To South America, East Coast	9
„ „ „ West „	1
„ Australia and New Zealand, viâ Cape of Good Hope	32
„ „ „ „ Suez	4
„ India, viâ Suez	7
„ India, viâ Cape of Good Hope	28
„ China Seas, viâ Cape of Good Hope	2
„ „ „ Suez	5
„ West Coast of Africa	1
„ Mediterranean Ports	2
„ Cape of Good Hope	3
„ West Indies	11
Between British Ports	6
Unknown	5
Total number of ships	143

Appendix II. (p. 34) supplies a list of the logs and of all the documents from stations abroad received at the Office during the year.

* Second Officer.

North Atlantic Weather Charts.—The investigation of the weather over the North Atlantic Ocean for the 13 months, beginning August 1st, 1882, and ending August 31st, 1883, the period during which the International System of Circumpolar Observations was carried out, has continued, during the interval covered by this Report, to employ nearly the whole Marine Branch of the Office, and steady progress has been made with the work. Nearly 3,000 ships co-operated, and 11,236 forms have been received, yielding an average of 864 for each of the 13 months, and upwards of 400 observations for each day. These figures are exclusive of the returns from land stations, which number about 300, so that there are in all about 700 sets of observations for each day. As seven of the circumpolar stations fell within the limits of the area dealt with (30° E. to 120° W.), their observations have been incorporated, and have rendered the charts for the higher latitudes far more complete than they would otherwise have been. Synchronous weather charts.

The principal features of the method adopted for carrying out the investigation, with specimen charts, will be found at pp. 8–10 of the Report for 1883. The series of these daily charts is published on a reduced scale in pairs, one chart representing the pressure and wind, the others the air and sea temperature, for each day, together with the record of weather (rain, &c.) which is reproduced on each chart, and the first two parts of this publication, containing 66 sheets, have already appeared. The charts for three consecutive days appear on each sheet.

The labour and time occupied in preparing the charts, and in carrying out this investigation, have been very great, and it is confidently hoped that the value of the results obtained from it will more than justify the expenditure which has been incurred.

The following statement shows the stage at which the work had arrived by the end of March 1887:—

The charts for April were in the lithographer's hands, and those for May were almost ready to be forwarded to him.

The reduced drawings from which the lithographed charts are produced, by the help of photography, have now to be prepared for the three remaining months, June, July, and August 1883, but beyond this there remains but little to be done to complete the work.

Red Sea Charts.—As the Atlantic work has advanced towards completion, the discussion of the Meteorology of the Red Sea has been taken up. Specimen charts for two months have been drawn, illustrating the barometrical pressure, the air and sea temperature, the winds, the currents, and the specific gravity of the sea. Meteorology of the Red Sea.

In order to render these charts as complete as possible application has been made for additional information to the Admiralty, the Royal Meteorological Institute of the Netherlands, and the Peninsular and Oriental Steamship Company.

The request was cordially granted in each case, and the results of a preliminary comparison of the charts prepared from each

Red Sea charts.

source of information separately, has shown that there exists a most satisfactory accordance between them, so that the observations may be at once combined for the final charts.

The tracks of steamers through the Red Sea are confined to such a narrow strip that it has been thought best to represent the instrumental data by curves along the margins of the chart, while the winds and currents are shown in position on the sea.

Pressure charts.

Charts of Barometric Pressure for the Atlantic, Pacific, and Indian Oceans.—These charts, which were referred to in late Reports are still in the hands of the engraver, they are, however, in an advanced state, and will probably be ready for issue in the course of the summer.

Current charts.

Current Charts for the Atlantic, Pacific, and Indian Oceans.—These charts (*see* Report, 1886, p. 8) are in progress; numerous observations contained in the Office logs have been dealt with, and the plotting of the currents in the Pacific Ocean for the months of February, May, and August have been completed. The paucity of data, more especially for the central part of the Pacific, is severely felt, and the Office has applied to several of the large steamship companies for the loan of the logs of their steamers, and the ready response with which the request has been met, leads the Office to expect that it will obtain much valuable material for the construction of the charts. The currents in the China Sea, as also along the west coasts of North and South America, are fairly represented.

Special attention has been directed to the currents, temperature of the sea and air, wind, weather, and the direction of the sea or swell, in the neighbourhood of Cape Guardafui during the South-west Monsoon, in the months of June, July, and August, these being the months in which the greatest number of casualties to shipping are reported to have occurred in this locality. The whole of the above elements are shown on large-scale charts, but it is feared that the result of the investigation will disprove the assertions that have been made that the differences in the meteorological conditions over different areas near this dangerous point are sufficiently marked to serve as a complete guide to the seaman. Northwards of Cape Guardafui, in the months referred to, the rise in temperature of the sea surface is very decided, but the reports received, stating that warm water (80° and upwards) is not found to the southward of the Cape, do not appear to be confirmed.

Charts of the Aden cyclone.

The Aden Cyclone of June 1885.—At the suggestion of Dr. Meldrum, of the Mauritius, the Council are collecting from all available sources information as to the weather over the North Indian Ocean in the month of June 1885, in order to prepare synchronous charts of that ocean for the space of about one month, with the hope of throwing some light on the causes which gave rise to this storm, and to its unusual course across the Arabian Sea, and in entering the Gulf of Aden.

Instruments belonging to the Office.

Supply and Stock of Instruments.—In Appendix III. (p. 48) will be found a list of the meteorological instruments supplied by

the Office to ships in the Royal Navy during the year, with a statement of the entire stock and distribution of instruments standing on the books, to the account of the Admiralty, on the 31st March 1887. Instruments belonging to the Office.

Appendix IV. (p. 49) gives similar information with regard to the disposal of the other instruments belonging to the Office, which are mainly supplied to the Mercantile Marine.

PART II.

Weather Telegraphy.

The service has been conducted without any serious interruption to its efficiency during the year.

The Council have to regret the death of Mr. D. MacDonald, who had been their observer at Stornoway for four years. At Prawle Point there has also been a change, owing to the promotion of Mr. John, who has been the reporter for six years.

A list of the telegraphic reporters will be found in Appendix V. (p. 50).

Inspection of the Telegraphic Reporting Stations.—The telegraphic reporting stations have been inspected during the year, in England (including Jersey and the Isle of Man) by the Rev. W. Clement Ley; in Scotland by Mr. Buchan; and in Ireland and Wales by Mr. Scott. The reports submitted by the Inspectors to the Council, which are printed in Appendix VI. (p. 51), show that the efficiency of the service has been fairly maintained. Inspection of the stations.

Discussion and Publication of the Information received.—A description of the practice of the Office in the collection, discussion, and dissemination of the meteorological information received by telegraph is given in Appendix VII. (p. 65). A list of the institutions and persons who received the Daily Weather Reports and Charts free of cost in 1886–7 forms Appendix VIII. (p. 76). Discussion of the reports.

Weather Forecasts.—There has been no material change in the system of preparation and issue of the forecasts during the year. Forecasts.

Forecasts are prepared three times a day, at 11h. a.m., and at 3h. 30m., and 8h. 30m. p.m. The Forecasts prepared at 11 a.m., on the information derived from the 8 a.m. reports, refer to the probable weather between noon on the day of issue and noon on the day following, and are publicly posted up in several places in London,* and supplied to the afternoon editions of the news-

* Viz., in the City, at the Mansion House, Lloyd's Rooms, Messrs. R. & J. Beck's, Cornhill, and Messrs. Thos. de la Rue & Co.'s, Bunhill Row; in the West End, in the Libraries of the House of Lords and House of Commons; at Messrs. Elliot's, St. Martin's Lane; Messrs. Stanford's, Charing Cross; Messrs. Negretti & Zambra's, Regent Street; and Messrs. Pastorelli's, New Bond Street.

papers. The forecasts prepared at 8h. 30m. p.m. are intended primarily for the newspapers, but any of the forecasts are available for the information of persons requiring them.

Inquiries at the Office.

The inquiries received through the Post Office for special forecasts during the year amounted to 53, and the personal applications to 33. The rules of the Office relating to such inquiries continue the same as in previous years, and are given in Appendix VII. (p. 75).

Testing of the forecasts.

The results of a comparison of the Forecasts issued at 8 p.m. during the year with the weather actually experienced is given in Appendix XI. (p. 82), and the following summary of successes and failures, estimated in the manner explained in that Appendix, shows that the average of success over the whole United Kingdom has been 81 per cent., the figure being slightly lower than that for the previous year, 83 per cent.

The district for which the forecasts have been least successful is Scotland, West. The same fact has been noticed during the last three years.

SUMMARY OF RESULTS of 8 p.m. FORECASTS, 1886.

Districts.	Percentages.				Total percentage of Success.
	Complete Success.	Partial* Success.	Partial* Failure.	Total Failure.	
SCOTLAND, N. - -	51	31	11	6	82
„ E. - -	52	29	12	7	81
ENGLAND, N.E. - -	52	32	10	6	84
„ E. - -	49	33	11	6	82
MIDLAND COUNTIES -	48	35	11	6	83
ENGLAND, S. - -	50	32	11	7	82
SCOTLAND, W. - -	42	33	13	11	75
ENGLAND, N.W. -	48	32	12	8	80
„ S.W. -	48	31	12	9	79
IRELAND, N. - -	48	34	10	7	82
„ S. - -	47	34	10	9	81
Summary - -	49	32	11	8	81

* Note "partial" implies "more than half."

Hay Harvest Forecasts.

Hay Harvest Forecasts.—The Council renewed in 1886 the offer made in the four previous years to the Royal Agricultural Society, the Royal Dublin Society, and the Highland Society to send daily Forecasts *gratis* during the hay season to a number of observers selected by the Councils of those Societies, on the two conditions, that the information should be made known as widely as possible, and that a record should be kept of the weather experienced and be sent in weekly to the Office. The Societies again

cordially accepted the proposal, and the following list of recipients was prepared :— Hay Harvest Forecasts.

LIST of those who received HAY HARVEST FORECASTS in 1886.

Districts.	To whom sent.	Address.
0. SCOTLAND, N.	Rev. Dr. Joass	Golspie.
	Major Smith	Munlochy, Inverness.
1. SCOTLAND, E.	G. Johnstone	Glamis, by Forfar.
	W. S. Macdonald	Craigielaw, Longniddry.
	A. F. Leslie	Braco, Keith.
	C. W. L. Forbes	Aberfeldy.
2. ENGLAND, N.E.	J. Wilson	Chillingham Barns, Belford, Northumberland.
	J. Turner	The Grange, Ulceby.
3. ENGLAND, E.	W. Birkbeck	High House, Thorpe, Norwich.
	Sir J. B. Lawes, Bt., and J. H. Gilbert, Ph.D.	Rothamsted, Harpenden.
4. MIDLAND COUNTIES	Royal Agricultural College.	Cirencester.
	E. E. Harcourt-Vernon	Grove Hall, East Retford.
5. ENGLAND, S.	C. Whitehead	Barming House, Maidstone.
	E. P. Squarey	The Moot, Downton, Wilts.
	G. M. Allender	Stammerham, Horsham.
6. SCOTLAND, W.	W. Calder	Castle Hill, Dalreoch, Dumbarton.
	M. J. Stewart	Ardwell, Stranraer.
	J. S. R. Ballingal	Eallabus House, Islay.
7. ENGLAND, N.W.	G. W. Wray	Leyburn, Yorkshire.
	The Earl of Derby	Knowsley Hall, Prescot.
	The Lord Egerton of Tatton.	Tatton Park, Knutsford.
8. ENGLAND, S.W.	Colonel J. B. Turbervill	Ewenny Priory, Bridgend, Glamorganshire.
	The Earl of Ducie	Whitfield, Falfield, R.S.O.
	T. Dyke	Long Ashton, Clifton, Bristol.
	R. Neville-Grenville	Butleigh Court, Glastonbury.
9. IRELAND, N.	Rev. A. Brown	The Manse, Hollymount, Co. Mayo.
	E. F. Farrell	Moynalty, Co. Meath.
10. IRELAND, S.	D. A. M'Cready	Larchvale, Moneygall, King's Co.
	D. A. Milward	Lavistown, Kilkenny.
	W. Talbot Crosbie, D.L.	Ardfert Abbey, Tralee, Co. Kerry.

The issue of the forecasts commenced June 17th with those for England, E., the Midland counties, and England, S., and later those for other districts were added. The forecasts were issued daily (excepting on Sundays), and in most instances they were continued for about five weeks.

Hay Harvest Forecasts.

The general result of this repetition of the issue of these forecasts, which began in 1879, is shown by the subjoined table, which has been compiled solely from the reports of the above-mentioned gentlemen, and is entirely independent of any estimate formed within the Office itself:—

SUMMARY of RESULTS. HAY HARVEST FORECASTS, 1886.

Districts.	Names of Stations.	Percentages.				
		Complete Success.	Partial Success.	Partial Failure.	Total Failure.	Total percentage of Success.
SCOTLAND, N.	Golspie and Munlochy	62	24	11	3	86
„ E.	Braco, Glamis, Aberfeldy, and Longniddry.	46	41	7	6	87
ENGLAND, N.E.	Belford and Ulceby	52	33	14	1	85
„ E.	Thorpe and Rothamsted	47	43	9	2	8
MIDLAND COUNTIES	Cirencester and East Retford	43	39	18	—	82
ENGLAND, S.	Horsham, Maidstone, and Downton	49	38	12	1	87
SCOTLAND, W.	Dumbarton, Islay, and Stranraer	66	20	13	1	86
ENGLAND, N.W.	Leyburn, Prescot, and Knutsford	57	27	14	2	84
„ S.W.	Bridgend (Glamorgan), Falfield, Clifton, and Glastonbury.	57	26	14	3	83
IRELAND, N.	Moynalty, and Hollymount	48	26	14	12	74
„ S.	Moneygall, Kilkenny, Ardfert Abbey	54	31	13	2	85
	Mean for all districts, 1886	53	31	13	3	84
	„ „ 1885	56	26	15	3	82

The result of this year's checking shows that the general per-centage was a little higher than in the preceding year. The largest general per-centage (89) was reached in England, E while the smallest (74) was in Ireland, N.

Independent testimony as to the correctness of the forecasts during the summer of 1886, and as to their value to, and appreciation by, the agricultural community was borne by Major Smith, Mr. Stewart, and Mr. Johnstone in Scotland, Mr. M'Cready in Ireland, and Mr. Birkbeck in England.

In addition to the gentlemen who acted as recipients of these forecasts in 1886, and whose names are given on page 11, six large landowners residing in different parts of the country applied for and received the forecasts at their own expense.

Storm warnings.

Storm Warnings for the Coasts of the United Kingdom.—In Appendix X. (p. 80) will be found the names of the stations which are furnished with signals for Storm Warnings, in accordance with Circular 717 of the Board of Trade issued in February 1874.

Storm warnings.

These stations were, at the end of March 1887, 141 in number, situated:—

69 in England, 14 in Wales, 39 in Scotland, 15 in Ireland, 3 in the Isle of Man, and 3 in the Channel Islands.

The usual comparison has been instituted in the Office between the warnings issued in 1886 and the weather experienced on our coasts, the warnings being tested by the method explained in Appendix VII. (p. 65). The results of the comparison are shown in the following tables:—

RETURN of the Result of the Comparison between the Warnings issued and the Weather experienced in 1886.

Coasts.	Total No. of Orders to hoist and repetitions.	Warnings justified by subsequent Gales. Force 8 and upwards.	Warnings justified by subsequent strong Winds. Forces 6 and 7.	Warnings not justified by subsequent Weather.	Warnings late. Force 9 reached at two Stations before issue.	Warnings partially late. Force 9 reached at one Station before issue.	Storms for which no Warning was issued.
Ireland, South -	61	35	13	10	—	3	April 7.
„ East -	76	33	28	14	—	1	—
Scotland, East -	56	38	7	9	1	1	May 15, June 15,* Dec. 8.†
„ West -	59	30	11	17	—	1	—
England, North-west	67	40	13	13	1	—	Jan. 13, Nov. 6.
„ West -	51	24	22	5	—	—	Jan. 13.
„ South-west	48	26	18	3	1	—	Dec. 12.
„ South -	50	33	12	5	—	—	Jan. 30, Sep. 27, Dec. 12.
„ South-east	36	17	12	7	—	—	Dec. 12.
„ East -	38	24	10	3	—	1	—
Totals - -	542	300	146	86	3	7	
Per-centages -	—	55·3	26·9	15·9	0·6	1·3	

* This gale was not felt south of Aberdeen.
† The northern part of the district was warned in time, but for the southern part the warnings were too late to be of any value.

NOTES, as to the GALES for which WARNINGS were not issued in 1886.

January 13th, England, N.W. and W.—At 6 p.m. 12th there was a large depression in the far N., passing away to the eastward, and moderate to fresh Westerly breezes prevailed over the British Isles. In the night, however, a subsidiary disturbance was developed over the North Sea, causing North-westerly gales on the coast named. It is not seen how this was to be foretold from the information available.

January 30th, England, S.—This gale was "strong" in the Solent only. It was caused by the extension of a large depression in the far N., and was increased by a small and very shallow subsidiary system which came up the Channel. Perhaps this latter deserved more attention than it received.

April 7th, Ireland, S.—The depression causing this gale advanced so rapidly, that it is remarkable that the signals did not fail on more of the coasts. At 6 p.m. 6th, the barometer was still rising, even at Valencia, and there was nothing but an

unreliable "cirrus" observation at Valencia to show that any depression was approaching.

May 15th, Scotland, E.—North-westerly and Northerly gale, caused by the spreading westwards of an apparently unimportant depression which was moving northwards over the North Sea, and a simultaneous temporary rise of the barometer in the N.W. Only one station (Aberdeen) reported force 9, and even there the anemometer registered only 42 miles per hour.

June 15th, East of Scotland, northern part.—A moderate gale from W. was already blowing in this region at 8 a.m. 15th, and as the barometer had begun to rise, it was anticipated that the depression in the far N. was passing off and that no stronger wind would be experienced. In the end, however, this proved to be an error.

September 27th, England, S. — Very similar to that of January 30. Caused by the spreading southwards of a gale which had been duly warned for in the more northern regions. It was "strong" in the Solent only. Strong squally breezes had been anticipated and forecasted.

November 6th, England, N.W.—This gale was caused by the sudden deepening of a depression which had been formed over Ireland early on the 6th. There was no gale at 6 p.m. 5th, and by 8 a.m. next day it was too late to warn this coast. Our other coasts were warned in time.

December 8th, Scotland E. (south of Moray Firth).—The depression which caused this gale was exceptionally deep; had it not been so this coast would not have suffered. Although the observations at 6 p.m. 7th showed no gale, all our other coasts were successfully warned.

December 12th, England, S.W., S., and S.E.—West-south-westerly gale caused by the development of a depression over the North Sea early on 12th. Of this there was no indication whatever at 6 p.m. on 11th.

Comparison of results for 1886 with previous years.

The following table contains a comparative statement of the storm warnings and their results in 1886, and in the ten preceding years. It will be seen that the percentage of warnings justified is 3 per cent. higher than in the preceding year:—

Years.	Total No. of Warnings issued.	Warnings justified by subsequent Gales.	Warnings justified by subsequent strong Winds.	Total Warnings justified.	Warnings not justified by subsequent Weather.
1876	265	61·1	21·5	82·6	11·7
1877	475	53·3	25·9	79·2	16·4
1878	485	56·7	20·8	77·5	17·9
1879	509	50·5	25·1	75·6	20·6
1880	390	58·2	24·6	82·8	13·3
1881	454	58·6	23·3	81·9	14·8
1882	503	61·4	21·1	82·5	14·9
1883	610	56·2	21·6	77·8	20·8
1884	461	66·4	20·0	86·4	12·1
1885	591	55·3	24·0	79·3	19·5
1886	542	55·8	26·9	82·2	15·9

The Prevalence of Gales on different Parts of the Coast.—At the suggestion of the Hydrographer tables giving the relative frequency of gales in the four quadrants respectively (N. to E., E. to S., &c.) on different districts of the coast, accompanied by illustrative diagrams, have been prepared. The tables refer to the period of 15 years, 1871–1885. An abstract is given in Note A, p. 21. Prevalence of gales.

Fishery Barometers.—In connexion with the subject of storm warnings the supply of public barometers to fishing stations and other places on the coast may be mentioned. The whole number of stations supplied with these instruments by the Office is at present 169, being the same as in the previous years. Of these stations, 60 are in England, 5 in Wales, 46 in Ireland, 54 in Scotland, 3 in the Isle of Man, and 1 in Jersey. The list is given in Appendix IX., p. 79. Fishery barometers.

A new edition of the Barometer Manual, designed for the information of the classes who will have access to the fishery barometers, is now under preparation.

Observations on Ben Nevis.—The arrangements with the Directors of the observatory established on the summit of Ben Nevis, at a height of 4,000 feet above the sea, detailed in the Report for 1885, have been continued during the year. The Council have continued the annual grant of 100*l.* towards the expenses of the observatory, and have received MS. copies of all the meteorological observations taken, and in addition occasional telegrams, 19 in number. A report on the practical value of these telegrams as aids to the service of forecasting, will be found in Note B., p. 23. Observations on Ben Nevis.

Atlantic Telegrams.—The service of occasional ship reports of storms met with west of the meridian of 45° W. was continued during the first half of the year, but in the month of November the new daily service, indicated in the last Report, was commenced. These telegrams give a general summary of the principal features of the atmospherical conditions over the United States, supplemented by ship reports. Atlantic telegrams.

The service is still carried on conjointly by the Central Meteorological Office in Paris and the Meteorological Council, the telegrams are received in Paris, and their contents are, for the present, transmitted to London by post. As in previous years, the collection of the information and transmission of the telegrams is undertaken by the Chief Signal Office, Washington, whose staff in New York and Boston are charged with the execution of the duty. A report on the results of this service during the three months January to March 1887, will be found at Note C., p. 24.

Weather Reports.—The Daily Weather Report has appeared regularly, and has been largely added to, and its general arrangement improved. For details, see Appendix VII., p. 69. The Weekly Weather Report has appeared in its enlarged form, as explained in the last Report, and has been further improved by the addition since 1st January 1887, of four new columns on the first page of Publications.

Publications.

each report, giving the difference between the weekly values for Accumulated Heat and Rainfall, and the means for the corresponding periods during the eight years 1878–85. The Quarterly Summary, issued as Appendix I., gives the Weekly and Progressive values of the same elements for all the districts in each month of the current year—in continuation of the Tables published in Appendices I. and II. for 1884, while Appendix II. gives the Weekly and Progressive values for Accumulated Heat, Rainfall and Bright Sunshine during the two years 1885 and 1886 (in continuation of Appendix II. for the year 1884), and Appendix III. gives the *Mean* Weekly values for the following number of years:—

Accumulated Heat and Rainfall, 8 years, 1878 to 1885.
Bright Sunshine - - 5 „ 1881 „ 1885.

The Monthly Weather Report has also appeared regularly.

Simultaneous observations.

Simultaneous Observations.—The Office has continued its co-operation in the system of simultaneous observations, taken once in every 24 hours, which was organised in 1874, at the request of the Chief Signal Officer of the United States.

The list of observers on this system at land stations for 1886 is given in Appendix XII., p. 87.

A form for the entry of the simultaneous observations is bound up with every ship's log issued by the Office. In previous Reports it has been stated that the Lords Commissioners of the Admiralty had, at the request of the Council, issued instructions for these observations to be taken (in addition to those made by the Service Regulations) on board each detached ship-of-war on foreign service; or, in the case of a squadron acting together, on board the ship of the senior officer. The number of these observations which have been received during the year from the Royal Navy has been 7,740, and from the Mercantile Marine, 6,570.

PART III.

Land Meteorology of the British Isles.

Observatories and Stations.—Records of the climate of the British Isles are received by the Office from certain stations with different degrees of fulness of organisation, which may be arranged in five classes.

Self-recording observatories.

1. The Observatories furnished with self-registering instruments by which all the principal meteorological phenomena are recorded continuously, and which thus afford materials for the study of the periodic variations of the meteorological elements.

Anemographic stations.

2. Anemographic stations furnished with instruments registering the wind only. The records from these stations relate to weather as distinguished from climate, and are especially useful in connexion with the passage of storms, and as affording evidence available in the courts of law with respect to collisions at sea, and damage done by wind.

3. Stations of the Second Order furnishing climatological information from eye observations taken twice a day. The observers at these stations are all volunteers. Stations of Second Order.

4. The Telegraphic Reporting Stations at which eye observations are taken, supplemented in some cases by self-recording aneroids, &c., forming the material upon which the daily weather reports and forecasts are based. The hours of observation at these stations are limited by the requirements of the telegraphic system, as explained in Part II., but the data which they furnish are utilized to afford climatological information for parts of the country where Stations of the Second Order do not exist. Telegraphic Reporting Stations.

5. Extra stations furnishing returns with less completeness, and with less detail than those of class 3. Extra stations.

A continuous record of the amount of bright sunshine is also received from 35 stations in the British Isles, some of which are first or second order stations, whilst from others the sunshine record is alone received. See p. 96. Sunshine stations.

A fuller account of these several stations and of the methods employed by the Office in dealing with the records they respectively furnish will be found in Appendix XIII., p. 88.

Appendix XIV., p. 92, contains a list of all documents relating to the land meteorology of the British Isles received at the Office during the year. Documents received.

The only changes in the self-recording stations during the year has been that the anemometer formerly at Seaham has been repaired and re-erected at Fleetwood at the suggestion of Mr. L. J. Crossley, to whom the instrument belongs, and who has kindly lent it to the Office. In addition, another similar instrument has been erected on the disused High Lighthouse, North Shields.

Inspection of the Stations.—The self-recording observatories and the anemographic stations (Classes 1 and 2), as well as the Telegraphic Reporting Stations (Class 4), are regularly visited each year by the Inspectors of the Office before mentioned (p. 9). The extra stations (Class 5) are inspected as opportunity offers. Of the Stations of the Second Order (Class 3), some belong to the Royal Meteorological Society; these are visited by an Inspector appointed by the Society, an allowance being made by the Office toward the cost of the inspection, in accordance with the recommendation of the Treasury Committee (1877). The remaining Stations of the Second Order, which are in immediate connexion with the Meteorological Office, are visited at least once in every two years by the Inspectors of the Office. The Superintendent of the Kew Observatory, Mr. G. M. Whipple, is specially employed to inspect and report on the self-registering apparatus, and on the photographic processes at the observatories. Extracts from the Reports of the Inspectors will be found in Appendix VI., p. 51. Inspection of Stations.

Minuteness of Barometer Readings.

Degree of Minuteness of Barometer Readings.—After consultation with the most eminent authorities both at home and abroad, as to the degree of minuteness to which it was desirable to read and record the height of the barometer, the Council resolved that, except in the case of the Standard Barometers used at the principal observatories, the readings should be made directly from the graduations of the verniers, without attempting to estimate smaller quantities.

Also, that the verniers of marine barometers belonging to the Office used at ordinary stations and supplied to ships be altered gradually, as they come in for repair, so as to read to 0·005 in. instead of 0·002 in. as at present.

And, that the registers of individual observations be printed to hundredths only, the readings to thousandths being limited to the mean values. This would not apply, however, to the hourly readings of the principal observatories.

It may be noted that ·004 of an inch corresponds nearly to one tenth of a millimetre, the degree of minuteness commonly adopted on the Continent.

Reports supplied to Registrar General for Ireland.

Information supplied to the General Register Office, Dublin.—Reports from ten of the Irish stations of the Office have been regularly supplied to the Registrar General for Ireland, for use in his Weekly and Quarterly Returns.

Publications.

Quarterly Weather Report.—Part IV., completing the volume for 1878 in the old form, is in an advanced stage, and good progress has been made with that for 1879. This form of Report will end with the publication of the results for 1880.

The volume of the *Monthly Weather Report* for 1886 has been published and the parts of that for 1887 are in preparation. This publication takes the place of the Quarterly Weather Report.

The publication of the *Hourly Readings* obtained from the records of the self-registering instruments at the four principal observatories for 1884, is nearly completed.

Reports from Stations of the Second Order.—The volume for 1882 has appeared, and that for 1883 is in hand.

Electric Anemometer.

Electric Anemometer.—This instrument has now been erected at Kilbeg Hill, situated above and at a distance of about a mile from the observatory at Valencia, but unforeseen difficulties have arisen, and it has not yet been brought into operation.

Harmonic Analyser.

The Harmonic Analyser.—The results of the analysis of the thermograms for the 12 years 1871–82 appeared as an appendix to the volume of Hourly Readings for 1883. They are given in three tables, of which the first two contain, in different forms, the harmonic coefficients of the formulæ expressing the daily march

of temperature; while the third, by a comparison of the monthly mean values obtained from the hourly values by computation with those derived from the analyser, supplies a means of testing the accuracy with which the machine works. The barograms are now being dealt with and are finished up to the end of 1875.

As it seemed desirable that the success of the Harmonic Analyser should be generally known, a paper describing the principal results obtained, and a determination of the trustworthiness of the computations was read before the Royal Society. (R. Soc. Proceedings, Vol. xli., p. 382.)

Records from stations of the Army Medical Department.

Records from Foreign Military Stations.—During the year the Office has received a very valuable contribution to its records of the climatology of the globe in the shape of the complete series of observations made by the officers of the Army Medical Department, at both home and foreign stations, during the years 1866–1884. These returns, taken together with those made by the Royal Engineers in the years 1852–1862, which were received from the Office of the Ordnance Survey in 1879, afford important information as to the climate of many parts of the world about which comparatively little is at present known, and the Council has, therefore, decided to publish the returns from all the foreign stations on a definite system, in the form of monthly means and summaries, so that this information may be generally accessible to meteorologists.

This work is now in hand and will be completed during the present year.

Library.

Library.

The library contains standard works on Meteorology and the allied sciences. It consists at present of nearly 10,500 volumes and pamphlets, exclusive of charts and MS. records of observations. The books and other documents are accessible to scientific men.

Appendix XV., p. 97, contains a list of the additions to the library during the year. These have been catalogued upon cards as before, besides being entered in the reference catalogues under (1) Authors, and (2) Subjects.

Expenditure.

Financial.

Appendix XVI., p. 123, shows the receipts and payments during the year ending 31st March 1887. The amount voted by Parliament was 15,300*l.*, as in the previous year.

The following abstract of expenditure shows the amount *properly chargeable* to the year in question, and its distribution under the

Financial.

various heads, together with the increase or decrease in 1886–87, as compared with the previous year :—

Net Expenditure.	1885-86.	1886-87.	Increase.	Decrease.
General Administration.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Payment of Council -	1,000 0 0	1,000 0 0	—	—
Secretary - -	800 0 0	800 0 0	—	—
Office - - -	769 19 0	792 12 0	22 13 0	—
Rent, fuel, and lighting -	707 5 10	721 6 1	14 0 3	—
Alterations to premises, attendance, and contingencies - -	403 14 8	596 19 1	193 4 5	—
Expenses incidental to International Meteorological Congress -	17 13 4	11 0 0	—	6 13 4
Pensions - -	42 16 4	42 16 4	—	—
Special Researches -	728 7 6	494 12 3	—	233 15 3
Land Meteorology -	3,160 1 6	3,207 15 4	47 13 10	—
Weather Information -	3,984 15 7	3,681 6 5	—	303 9 2
Inspections - -	549 9 9	559 16 9	10 7 0	—
Ocean Meteorology -	2,845 18 3	2,924 8 1	78 9 10	—
Total - £	15,010 1 9	14,832 12 4	366 8 4	543 17 9

(Signed) Rd. STRACHEY.
Chairman of the Council.

NOTE A.

On the DISTRIBUTION of GALES round the COASTS of the BRITISH ISLES.

The subjoined table gives the total number of general gales reported in each of the 10 districts into which the coasts of the United Kingdom have been divided. The figures refer to the period of 15 years, 1871–85 inclusive. The table also gives the percentage proportions of the general gales in each district for each month, and for the four quadrants.

The term "General gales" implies that the gale has been reported from more than half the stations situated in the district.

	Monthly per-centages of the Total Number of General Gales reported in each District in the 15 years, 1871–1885 inclusive.												Total Number of General Gales.	Per-centages of the Total Number of General Gales reported in each District, arranged according to the Four Quadrants.			
	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.		N.E.	S.E.	S.W.	N.W.
The Shetlands - -	16	13	11	8	1	1	2	8	6	13	14	15	281	14	29	30	26
Scotland, East - -	15	13	12	4	1	—	—	8	6	15	16	13	229	9	28	33	35
Scotland, North-west -	17	14	15	8	1	—	1	1	5	13	16	13	275	7	16	44	33
Ireland, North - -	16	14	15	8	1	1	1	2	4	13	15	13	198	6	18	42	34
Ireland, South-west -	21	14	10	5	2	1	1	2	6	10	15	12	277	5	16	62	17
The Irish Sea - -	18	10	10	8	1	1	1	8	6	14	17	14	265	7	14	50	28
England, North-east -	16	9	16	4	1	8	8	8	5	14	15	11	172	17	18	40	25
England, East - -	22	8	10	4	—	—	—	8	4	14	18	14	160	15	11	57	16
England, South - -	15	8	8	5	2	1	1	7	7	14	17	16	190	8	5	54	33
England, South-west -	15	12	10	6	2	2	1	5	6	13	15	13	328	6	15	46	32

NOTE B.

REPORT on OCCASIONAL TELEGRAMS received from BEN NEVIS.

MEMORANDUM.

THE primary object which has been kept in view while checking the telegrams received from Ben Nevis during these 16 months has been to ascertain how far the telegrams, as at present sent, have been of service as aids to the issue of storm warnings from the Meteorological Office.

To make this clear a table (annexed) has been prepared, showing the time of receipt of all the messages which arrived from Ben Nevis between 1st January 1886 and 30th April 1887, together with a brief statement as to the atmospheric conditions prevailing at the time when the telegram arrived, and the steps taken with regard to the issue of warnings to our coasts.

The messages received consisted of observations of pressure, temperature, wind, and weather made on the summit at two distinct hours, supplemented occasionally by a word or two as to the general appearance, &c.

During this period we issued from the Meteorological Office 86 warnings to the Scotch coasts, but we received from Ben Nevis only 19 telegrams. Of these two arrived before we issued the warnings, and on those occasions the receipt of the telegrams in no way influenced us in determining to warn.

When the observations made on Ben Nevis shall have been thoroughly discussed, and inferences deduced from them by the Ben Nevis Committee, it is possible that a new system of telegrams may be arranged, which should be of practical value to the Meteorological Office; at present, however, no such discussion has been published, and in their existing form the telegrams have given us no assistance.

(Signed) FREDC. GASTER.

To R. H. Scott, Esq.,
Secretary.

TELEGRAMS received at the METEOROLOGICAL OFFICE from BEN NEVIS between January 1st, 1886, and April 30th, 1887.

Date of receipt of Telegrams.	Condition of Atmosphere about Time of Receipt of Telegram.	Warnings issued by the Office on other information.	Whether the receipt of the Ben Nevis Telegram was before or after issue of Warnings.
1886. January.			
7th, 6.47 p.m.	Depression in far north -	S. cone had been re-hoisted in N. and N.W. for 8 hours.	After
13th, 8.56 a.m.	Deep depression in far north and subsidiary.	N. cone had been re-hoisted in N. and N.W. for 24 hours.	"
14th, 7.12 p.m.	New depression advancing from N.W.	N. cone was still up - -	"
16th, 5.14 p.m.	Depression approaching W. of Scotland.	N. cone hoisted northern coasts 7.15 p.m. (W. and S.W. had been warned in afternoon.)	Before
29th, 9.5 a.m.	Deep depression in N.W.	S. cone had been hoisted previous day.	After

Date of receipt of Telegrams.	Condition of Atmosphere about Time of Receipt of Telegram.	Warnings issued by the Office on other information.	Whether the receipt of the Ben Nevis Telegram was before or after issue of Warnings.
1886.			
February.			
5th, 6.43 p.m.	Depression off Wn. coasts moving North-eastwards.	S. cone had been hoisted in morning.	After
March.			
26th, 6.50 p.m.	Large depression in N.W.	No signals hoisted. No gale Scotland. Fresh S.S.W. gale on W. coasts *before* message arrived.	"
27th, 8.46 a.m.	Subsidiary depression in N.W.	S. cone hoisted in W. and S. at 10 a.m., 27th. No gale in Scotland.	Before
30th, 2.57 p.m.	Deep depression in N.W.	S. cone had been hoisted for above 4 hours.	After
April.			
1st, 6.55 p.m.	Deep depression off W. coasts.	S. cone had been re-hoisted for many hours.	"
7th, 2.56 p.m.	Deep depression off W. coasts.	S. cone had been hoisted since 10 a.m.	"
8th, 8.44 a.m.	Yesterday's depression over Scotland, subsidiary Irish sea.	S. cone still up - - -	"
May.			
17th, 6.40 p.m.	Depression in N.W. moving North-eastwards.	S. cone had been hoisted W. Scotland since 4 p.m. (In Ireland it had been up much longer.)	"
18th, 8.48 a.m.	Yesterday's depression now over Scotland, and grown complex.	We had lowered cone again N. and N.W., and no gale came.	"
September.			
9th, 0.45 p.m.	Depression in W. moving N.Ewd.	S. cone had been hoisted since 10 a.m.	"
October.			
9th, 6.48 p.m.	Depression in W. moving N.E.	S. cone had been hoisted since 10 a.m.	"
December.			
6th, 8.30 a.m.	Exceptionally deep depression in N.W.	S. cone had been hoisted in W. and N.W., 7.15 p.m., 7th, and on other coasts next morning.	"
8th, 7.25 p.m.	Exceptionally deep depression in N.W.		
1887.			
January.			
11th, 8.45 a.m.	Deep depression in N. -	S. cone had been hoisted previous day.	"

NOTE C.

REPORT on the DAILY WEATHER MESSAGES received from the UNITED STATES (viâ Paris) during the three months January to March 1887.

THE following report on the telegrams received at the Meteorological Office daily from the United States (viâ Paris) is made in order to show how far the telegrams have been of service to the Meteorological Office as aids to the issue of forecasts or storm warnings. In order to do this those cases have been selected in which a well-formed depression was shown over the United States or the adjacent parts of the Atlantic, having a motion in a more or less easterly direction. These have been tabulated and compared with the depressions which reached the shores of north-western Europe from the Atlantic, and caused gales on some part

of the coasts. The coasts on which gales occurred were noted in all cases in which they were partial.

Appended is a copy of the table referred to, and to it have been added columns showing (1) the position in which the depressions were observed on the western side of the Atlantic; (2) the dates on which we received information of their existence—whether of an indefinite or uncertain kind, or of a definite or certain kind; and (3) as to the date on which it was reckoned that the system would be due in our neighbourhood supposing it to cross the Atlantic at all.

Some remarks are added where deemed necessary, and finally a column has been inserted showing the character of the information when looked upon as an indication of the weather on our coasts, as follows:—

A = complete success; B = partial success; C = total failure.

From the last column we gather that, out of the 20 depressions reported on the western side of the Atlantic during the three months:—

5 were classed A, or completely successful, as indications of weather in north-western Europe.

4 were classed B, or partially successful, as indications of weather in north-western Europe.

11 were classed C, or failures, as indications of weather in north-western Europe.

In addition to these there were seven depressions, causing gales, which reached our coasts, and which I fail to connect with any depression known to have occurred previously over the United States or the western Atlantic.

In some of the cases which have been classed A or B (*e.g.*, that shown at midnight of January 29th and at noon on February 1st), the telegrams which gave definite information as to the disturbance did not reach us until after the system had actually arrived. In others the gales which occurred were so partial and felt at ports lying so far to the north-westward that, to the coasts of the British Islands, the warnings may be considered as of little value.

Referring now to the character of the telegrams, it may be said:—

(1.) That the system hitherto in use of showing the distribution of pressure over continental America has not answered, the information being much too scanty. It is proposed by M. Mascart, on the recommendation of Mr. Finley (U.S.), to substitute for this a new system of reporting by which the form and (approximately) the intensity of the depressions observed over the United States and the times of their exodus to the Atlantic, will be better indicated. This, if successful, will be a very decided improvement, but is likely to involve a much larger expense, unless it is accompanied by a considerable reduction in the quantity of information transmitted from ships. It should, however, be observed that, under present arrangements, information from ships

often arrives so late that it is of little value as a warning, while a large proportion of the depressions reported do not come from the American Continent at all. It is a question whether these latter do not cross the Atlantic more frequently than those which come from off the land, so that if the reporting of ships' observations could be accelerated, some improvement might result.

(2.) The number of observations obtained from ships has often been far greater in quiet weather than was necessary. This might with advantage be curtailed, as the object of these messages is to serve as warnings of storms which appear to be on their way towards us from the Western Atlantic.

(3.) The barometrical readings reported are unsatisfactory often being irreconcilable one with another. But how far this is due to errors in the telegraphy is not known.

(4.) The observations of ice and of derelict ships are probably very useful, and are being transmitted to Lloyd's immediately they come to hand.

I cannot help thinking that in the form hitherto adopted, these reports are of no practical value whatever for the purpose of forecasting, and unless much more money is available, I do not see how they are to be materially improved.

Under any circumstances, in the present state of our knowledge the aid derived from such transatlantic messages must be very slight, and at times the knowledge that a deep depression has left the United States has caused the premature issue of warnings to our coasts, and a consequent failure which would otherwise have been avoided.

(Signed) FREDC. GASTER.
18th May 1886.

To R. H. Scott, Esq.,
Secretary.

TABLE showing what STORM SYSTEMS were observed over the UNITED STATES and WESTERN ATLANTIC during the three months January–March 1887, and how far the Telegrams containing Information as to their Existence might have been of Use, as Aids to the Issue of Storm Warnings to the British and Irish Coasts.

Date of Observation. 1887.	Approximate Position of Centre of Depression.	Date when Report of Depression was received in London.		When estimated to be due off Coasts of N.Wn. Europe.	Depressions (causing Gales) which appeared on the Coasts of N.Wn. Europe.	Remarks.	Whether the Report was, or was not, received in time for use as Warning.
		Of an Uncertain character.	Of a Certain character.				
January.	Lat. N. Long. W.	January.	January.	January.			
2nd, Noon -	42° 65°	6th	6th, 7th	7th	Did not arrive - - -	- - - - -	No.
—	—	—	—	—	Rather deep depression, Hebrides, 11th; "V"-shaped subsidiary.	- - - - -	No warning.
7th, „ -	44 68	- -	13th	11th to 12th	Rather deep off the Hebrides, but at great distance to N.Wd. 13th; Southerly gales in extreme W. only.	- - - - -	Yes.
10th, & 11th, „ -	48 67	- -	16th	15th	Depression in N.W. on 16th; Southerly gales in extreme N.W. and N.	- - - - -	Yes.
					Deep large depression in W. and N.W.; strong Southerly gales on 17th.	- - - - -	No warning.
					Depression in W. evening of 18th; S.S.E. to S.W. gales.	- - - - -	No warning.
18th, „ -	48 68	- -	23rd	24th (moving fast).	Large and deep in W. on 24th—26th; Gales Westerly and Northerly.	- - - - -	No.

TABLE showing what STORM SYSTEMS were observed over the UNITED STATES and WESTERN ATLANTIC—*continued.*

Date of Observation. 1887.	Approximate Position of Centre of Depression.	Date when Report of Depression was received in London. Of an Uncertain character.	Date when Report of Depression was received in London. Of a Certain character.	When estimated to be due off Coasts of N.Wn. Europe.	Depressions (causing Gales) which appeared on the Coasts of N.Wn. Europe.	Remarks.	Whether the Report was, or was not, received in time for use as Warning.
January.	Lat. N. Long. W.	January.	January.	January.			
22nd, Noon	43° 63° (small and doubtful).	- -	25th	28th	Large system far away to the N.Wd. of our Islands on 27th and in N. on 28th. Southerly gales in W. and N.W. of our Islands.	- - - - -	No.
					A similar disturbance on 28th—29th.	- - - - -	No warning.
25th, ,, -	48 63 (Very large system and moving S.E.)	28th & 29th.	30th	29th to 31st	Deep and large in N.W. on 31st. Southerly gales. Subsidiary in S.E. on Feb. 1st.	The motion of this system on other side of Atlantic makes it very doubtful whether it and the one which reached our shores are identical.	No.
29th, Midt. -	45 83	30th					
30th, ,, -	47 70	31st	- -	February. ? 3rd (moving very fast).	Large and deep, in N.W. on 2nd, moving very fast. Strong Southerly gales.	The "Certain" intelligence arrived nearly a week too late.	No.
February.			Feb.				
1st, Noon -	48 53	- -	7th–8th				
3rd, Midt. -	46 65	4th	8th, 9th	? 10th (moving fast).	Did not arrive - - -	- - - - -	No.
4th, Noon -							
7th, ,, -	43 60	10th	11th	12th	Did not arrive - - -	- - - - -	No.
8th, Midt. -	47 67	9th	11th–14th	14th	Did not arrive - - -	- - - - -	No.

TABLE showing what STORM SYSTEMS were observed over the UNITED STATES and WESTERN ATLANTIC—*continued.*

Date of Observation 1887.	Approximate Position of Centre of Depression.		Date when Report of Depression was received in London.		When estimated to be due off Coasts of N.Wn. Europe.	Depressions (causing Gales) which appeared on the Coasts of N.Wn. Europe.	Remarks.	Whether the Report was, or was not, received in time for use as Warning.
			Of an Uncertain character.	Of a Certain character.				
February.	Lat. N.	Long. W.	February.	February.	February.			
10th, Midt.	45°	75°	11th	15th & 16th.	16th	Large, in extreme N.W. on 16th	This disturbance was too far away for its intensity to be known. The "Certain" information arrived too late to be of much use.	No.
11th, „ -	45	64				Moderate gales only, in extreme N.W.		
14th, Noon	43	55	- -	20th	18th or 19th	Large, in N.W. on 20th, but *no gales.*	Information received too late, even if the gales had arrived.	No.
						Very large, in N.W. on 22nd and 24th, S.Wly. gales in W. and N.	- - - - -	No warniug.
						Large in far W. on 26th -	- - - - -	No warning.
23rd, „ -	40	58	- -	28th	28th	Moderate, but deep, over N.W. of Norway on 28th. S.W. gale in far north.	Our coasts little affected by gale. Information rather too late.	No.
23rd, Midt.	40	85	24th	- -	March. 1st	Moderate, deep, in N. of Norway on March 2nd. Gales at Christiansund only. Our Islands not affected.	The telegram conveying "Certain" information arrived too late.	No.
24th, „ -	45	65	25th	- -				
26th, Noon	47	55	-	March. 3rd				
26th, Midt.	47	65	27th	- -	? 5th (See remarks).	Sn. portion of a large system reached the N. of Norway early on 6th. (No gales.)	The movement of this system over Maine and Labrador seemed to indicate that it might probably not reach our coasts at all.	No.
27th, „ -	52	62	28th	2nd & 3rd				

TABLE showing what STORM SYSTEMS were observed over the UNITED STATES and WESTERN ATLANTIC—*continued.*

Date of Observation. 1887.	Approximate Position of Centre of Depression.		Date when Report of Depression was received in London.		When estimated to be due off Coasts of N.Wn. Europe.	Depressions (causing Gales) which appeared on the Coasts of N.Wn. Europe.	Remarks.	Whether the Report was, or was not, received in time for use as Warning.
			Of an Uncertain character.	Of a Certain character.				
March.	Lat. N.	Long W.	March.	March.	March.			
1st, Midt.	47°	88°	2nd	—	6th (Moving very fast.)	Did not arrive	Had the system reached us the "Certain" information would have arrived too late.	No.
2nd, „	44	65	3rd	7th				
10th, „	42	65	11th	16th	Uncertain. Movements very peculiar and irregular.	Did not arrive	- - - - -	No.
11th, Noon								
12th, „	42	62						
13th, „	42	55						
—	—		—	—	—	Large depression; reached W. of Ireland 21st, and a "V"-shaped subsidiary next day. Deep secondary system on 23rd. Gales very generally.	- - - - -	No warning.
21st, Noon	43	53	25th	27th	Uncertain; moving very rapidly.	Moderate (increasing) in N. on 26th. Gales in north.	Information received much too late.	No.
21st, Midt.	36	75	22nd	—	28th	Did not arrive	- - - - -	No.
22nd, „	-	- -	23rd	—				
23rd, Noon & Midt.	45	68	—	25th&27th				
24th, Midt.	42	47	25th	30th	30th moving fast.	Small, but deep; off Nn. coasts on 30th, whence it moved S.Ewds.	The telegram conveying "Certain" information arrived too late."	No.

APPENDIX.

APPENDIX.

APPENDIX I.

LIST of CAPTAINS (and Officers) who have sent in Logs classed as "Excellent" during the year ending March 31, 1887. The figures opposite to each show the total number of such Logs which they have returned to the Office during the period that they have been observing.

Captain's Name.	Number of "Excellent" Logs.	Ship.
Adamson, A. W. - -	4	S.S. "Brindisi."
Balfour, Lieut. Andrew, R.N. -	19	H.M.S. "Rambler."
Barker, D. W., F.R.Met. Soc.	10	S.S. "International" and S.S. "Buccaneer."
Barlow, B. J., R.N.R. -	13	S.S. "Tainui."
Barrett, T. - - -	1	"Craigburn."
Baxter, A. S. - - -	2	"City of York."
Bennett, E. C. - - -	12	"Thessalus."
Blackburne, Mr. H. J. -	1	S.S. "Brindisi."
Blake, E. J. - -	11	"Tilkhurst."
Bolton, S. H. - - -	7	S.S. "Helen Newton."
Bright, H. - - -	1	"Beltana."
Buchan, James - -	19	"Coppename."
Campbell, Archibald - -	17	S.S. "Circassia."
Campbell, James - -	5	"Saint Patrick."
Carr, H. C. - - -	2	"Superb."
Chaddock, G. A. - -	1	"Elissa."
Clapp, Staff Comr. E. S., R.N.	3	L.H. Tender "Richmond."
Clarke, James - - -	7	S.S. "Olbers."
Cooke, C. F., F.R.Met.Soc. -	3	"Melbourne."
Crighton, A. T. - -	1	S.S. "Colina."
Crotty, F. H. - - -	3	"Evesham Abbey."
Crowley, C. - - -	1	"Lucia."
Crutchley, William Caius, R.N.R.	12	S.S. "Kaikoura."
Dart, Leonard C. - -	7	"Alcester."
Davies, Joseph - -	2	S.S. "Flaxman."
Dawson, Comr. L. S., R.N. -	2	H.M.S. "Sylvia."
Denham, George - -	9	S.S. "Ocean King."
Deuchars, William - -	5	S.S. "Jan Mayen."
Dobson, C. M. - -	11	S.S. "Durham."
Douglas, Lt. H. H., R.N. -	2	H.M.S. "Sylvia."
Draper, R. - - -	2	S.S. "Monarch."
Dunbar, John Ivor - -	8	S.S. "Arracan."
Ellery, William - -	16	"Talookdar."
England, Thomas - -	5	"Jane."
Evans, Mr. E. J. - -	4	S.S. "Tainui."
Flinton, Benjamin - -	2	"Dartmouth."
Gordon, James - -	11	S.S. "City of Agra."
Graham, W. Vincent - -	3	"Majestic."
Gray, David - - -	13	S.S. "Eclipse."
Gray, H. W. - - -	1	"Pleione."
Gray, John - - -	10	S.S. "Hope."

Captain's Name.	Number of "Excellent" Logs.	Ship.
Hayward, G. O. - -	4	S.S. "Dunrobin Castle."
Holdich, John Peach, R.N.R. -	11	"British Envoy."
Hoskyn, Comr. R. F., R.N. -	13	H.M.S. "Myrmidon."
Hughes, W. P. - -	8	"Laomene."
Irving, P. J. - - -	4	S.S. "Republic."
Jones, S. Griff -	6	"Hermine."
Kennedy, C. W.	6	S.S. "Germanic."
King, J. W. - - -	1	"Philomene."
Ladd, Mr. Richard, F.R.A.S., F.R.Met.Soc.	16	S.S. "Minia."
Lalley, William Nicholson -	8	S.S. "Boyne."
Lambert, H. M., Sub-Lieut., R.N.R.	5	S.S. "Brindisi."
Lancaster, Mr. C. - -	4	S.S. "Germanic."
Leportier, T. - - -	2	S.S. "Mira."
Lyne, Lieut. W. O., R.N. -	5	H.M.S. "Flying Fish."
Machugh, R. H. - -	1	S.S. "Ching Wo."
McLean, Archibald - -	2	S.S. "Concordia."
Maclear, J. F. L. P., R.N. -	16	H.M.S. "Flying Fish."
Marshall, Frederick - -	2	"Wiltshire."
Maxwell, Joseph - -	2	"Oamaru."
Mesnard, Thomas - -	5	"Sierra Miranda."
Metcalfe, John - -	10	S.S. "Oceanic."
Milne, W. F. - - -	4	S.S. "Esquimaux."
Moore, Comr. W. U., R.N. -	9	H.M.S. "Rambler."
Murdoch, H. - - -	5	"Penthesilea."
Murdoch, Peter - -	8	"Sierra Estrella."
Murray, Alexander - -	5	"Perseverance."
Norman, Francis - -	5	"Polestar."
North, W. G. - - -	4	S.S. "Tiger."
Parry, Moses, F.R.Met.Soc. -	10	S.S. "Prydain."
Parsell, Henry - -	11	S.S. "Adriatic."
Parson, George Fry - -	6	"Earnock."
Pearson, Charles William -	26	S.S. "Strathleven."
Potter, Thomas - -	5	S.S. "Sulina."
Price, J. H. - - -	2	"Viola."
Prout, John Cawse - -	5	"Cape St. Vincent."
Quaile, D. W. A. - -	2	"Orissa."
Randall, William - -	9	"Earl of Shaftesbury."
Renaut, Charles Henry -	16	"Pleione."
Ross, Alexander - -	2	"Berbice."
Rosseter, William Lawrence -	7	"St. Kilda."
Russell, Charles James -	6	"Khyber."
Sargent, A. H. - - -	2	"Glenlora."
Scott, William - -	18	"Commewyne."
Shearer, G. - - -	8	"Thetis."
Sheldrake, J. W. - -	2	"Iron Cross."
Simpson, Alexander - -	5	S.S. "Australasian."
Simpson, Alexander - -	17	"Traveller."
Smith, Sub-Lt. F. Bowden, R.N.	3	H.M.S. "Myrmidon."

Captain's Name.	Number of "Excellent" Logs.	Ship.
Smith, W. C., F.R.Met.Soc. -	10	"John R. Worcester."
Spratly, W. - - -	9	S.S. "Mozart."
Sturdee, H. King - -	6	L.H. Tender "Richmond."
Thomson, A. S., F.R.Met.Soc.-	8	S.S. "Silvertown" and S.S. "Buccaneer."
Trott, Samuel, F.R.Met.Soc. -	8	S.S. "Minia."
Trunks, H. - - -	1	"Aldborough."
Walker, Henry - -	7	S.S. "Cephalonia."
West, F. - - -	1	S.S. "Port Adelaide."
Wheaton, N. J. - -	5	"Eliza."
Williams, H. - - -	1	"Dynomene."
Wilson, William - -	8	"Horsa."
Youlden, H. - - -	6	"May Hulse."

Names of observers deceased printed in italics.

APPENDIX II.—Ships supplied and Documents returned during the year ending 31st March 1887.

The number of merchant ships supplied with standard instruments and meteorological logs during the above period was 164.

The number of meteorological logs, and documents from Foreign Stations, received during the same period, and registered in the Office, amounted altogether to 346, of which 186 were returned from ships, and the remainder from land stations, outside the British Isles.

List of Documents received from Foreign Land Stations.

Place.	Observer.	No. of Documents.	Nature of Observations.
Abaco (Bahamas) - -	G. L. Nairn and C. H. Bode, Lightkeepers.	2	"Lighthouse" Register, July 1885 to June 1886.
Ascension - - -	Capt. J. W. East, R.N. -	1	Observations of Rollers, 1876-1877.
Barbados (Commercial Hall) -	T. L. Ince - - -	1	"Lighthouse" Register, January to December 1886.
„ (Joe's River House) -	R. B. Walcott, M.D., F.R. Met. Soc.	1	„ „ „ „ „ „
Bermuda - - - -	Sergt. J. Green, Medical Staff Corps.	8	Anemograms, January 1886 to February 1887.
Beyrout (Lee Observatory) -	R. H. West, M.A. - -	12	Two observations daily, March 1886 to February 1887.
Cape Juby (North-West Africa) -	S. Morris, for the North-west African Co., Limited.	12	„ „ „ „ „ „
Cape Pembroke (Falkland Islands)	G. K. Broom, Lightkeeper -	2	"Lighthouse" Register, January to December 1886.
Cay Lobos (Bahamas) - -	R. A. A. Espie, Lightkeeper	2	„ „ January to June 1885, and January to June 1886.
Cay Sal (Bahamas) - -	T. R. Thompson, Lightkeeper	1	„ „ January to June 1886.
Famagusta (Cyprus) - -	G. Eliades - - -	13	Two observations daily, July 1883 to July 1886.
George Town (British Guiana) -	Robert Ward - -	1	„ „ „ January and February 1887.

LIST of DOCUMENTS—*continued.*

Place.	Observer.	No. of Documents.	Nature of Observations.
Gibraltar - - - -	Privates E. Irvine and E. Herrick, Med. Staff Corps.	12	Two observations daily, March 1886 to February 1887.
Heligoland - - -	Lightkeepers - -	11	Eight observations daily, March 1886 to February 1887.
Inagua (Bahamas) - -	N. H. E. Garner, Lightkeeper	2	"Lighthouse" Register, July 1885 to June 1886.
Kyrenia (Cyprus) - -	E. Joannides and C. Natai -	13	Two observations daily, July 1883 to July 1886.
Larnaca (Cyprus) - -	A. Tsepis and I. Laffan -	13	" " " " " "
Limassol (Cyprus) - -	Luigi Béraud -	13	" " " " " "
Nicosia (Cyprus) - -	A. Kyriakides, P. Joannides, G. Stephen, N. Yeremias, E. Joannides, and J. Elliog.	13	" " " " " " (except March, June, and September 1885.)
Papho (Cyprus) - - -	E. A. Malliotis - -	13	" " " " " "
Sombrero - - -	J. A. Richardson, Lightkeeper	2	"Lighthouse" Register, December 1885 to November 1886.
Suva (Fiji) - - -	J. D. W. Vaughan, F.R.Met. Soc.	11	One observation daily, January to November 1886.
Tangier (Morocco) - -	Sir J. Drummond Hay, K.C.B.	1	Three observations daily, October 1886 to November 1888.

List of Documents received from Ships.

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
[1] Adamson, A. W.	S.S. Brindisi	2,143	P. & O. Steam Navigation Co., London.	To and from Calcutta, viâ Suez	1886
[1] „ „	„	„	„ „ „	To and from China, viâ Suez	1886
[2] „ „	„	„	„ „ „	To Calcutta, Marseilles, and home, viâ Suez	1886–87
Alderton, T.	S.S. Nepaul	1,988	„ „ „	To and from China, viâ Suez	1885–86
Armour, William	County of Aberdeen	—	Robert Craig, Glasgow	To Buenos Ayres, Calcutta, and home	1883–84
Auld, John H.	Loch Broom	2,075	James Aitken, Glasgow	To Melbourne, Calcutta, and home	1885–86
Balderston, R. J.	Bactria	2,122	Sir Thomas Brocklebank, Bart., Liverpool.	To and from Calcutta	1885–86
[3] Barker, D. W., R.N.R., F.R.G.S., F.R. Met. Soc.	S.S. International	1,014	India Rubber, Gutta Percha, and Tel. Works Co., London.	To and from Key West, U.S.A., and laying cable in Florida Straits and off Cuba	1886
„ „	S.S. Buccaneer	460	„ „ „	To West Coast of Africa and laying cable	1886
[4] Barlow, B. J., R.N.R.	S.S. Tainui	3,231	Shaw Savill and Albion Co., Lim., London.	To Cape Town, Hobart, New Zealand, Rio Janeiro, Teneriffe, and home	1886
[4] „ „	„	„	„ „ „	To and from Lyttelton, viâ Cape	1886
[5] Barrett, Thomas	Barque Craigburn	1,997	R. Shankland, Greenock	To and from Calcutta	1886–87
Barrette, J. C.	Cæsarea	1,257	W. Pellier, St. Heliers, Jersey	„ „	1885–86
Baxter, A. S.	City of York	1,195	G. Smith & Son, Glasgow	To Sydney, San Francisco, and home	1885–86
„ „	„	„	„ „	To and from San Francisco	1886–87
Bennett, E. C.	Thessalus	1,782	T. Carmichael, Greenock	To Sydney, San Francisco, and Havre	1886–87
[6] Black, Donald	Loch Ryan	1,207	James Aitken, Glasgow	Home from San Francisco	1884–85
Blake, Edwin John	Tilkhurst	1,527	"Tilkhurst" Ship Co., Lim., London.	To Singapore, and home from Calcutta	1885–86

LIST of DOCUMENTS, *&c.—continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
Bolton, S. H.	S.S. Helen Newton	1,330	A. J. Newton, London	To Rio Janeiro, Buenos Ayres, and home	1886
" "	" "	"	" "	To Stockholm, Alexandria, and home.	
				To Alexandria, Sulina, &c., and Havre	1886–87
Brehant, G. J.	Barque Achievement	499	J. Barker, Liverpool	To and from Autofagasta	1886
Bright, Henry	Beltana	741	A. Lang Elder, London	To and from Adelaide	1886–87
Brolly, R. H.	S.S. John Knox	1,351	Neil McLean, Glasgow	To Singapore, China Ports, Port Said, and home; and from Hamburg to Montreal, and home	1885–86
Brown, E.	Barque Moorhill	484	E. Brown, Liverpool	To Buenos Ayres, Galveston, and home	1886–87
Brown, James	S.S. Olympia	1,416	T. Henderson & Co., Glasgow	Two voyages from Gibraltar to New York, and home	1886
Browne, W. G.	S.S. Neto	1,091	G. Page, Liverpool	To and from Charleston	1886–87
Buchan, James	Barque Coppename	316	J. C. Pearson, Glasgow	To Surinam, Barbadoes, Jamaica, and home	1886
Callaghan, M.	S.S. Lara	471	Waterford S.S. Co., Lim., Waterford.	Trading between Waterford, Liverpool, and Bristol	1885
" "	"	"	" " "	" " "	1886
" "	"	"	" " "	" " "	1886
" "	"	"	" " "	" " "	1886
" "	S.S. Reginald	516	" " "	" " "	1886
Cameron, John	S.S. Ivanhoe	599	J. P. Maclay & Co., Glasgow	To and from Cape of Good Hope, and from Cardiff to Spanish Ports and home	1885–86
[7] Campbell, Archibald	S.S. Circassia	4,272	The Barrow Steam Ship Co., London.	Five voyages to and from New York	1885–86

TABLE showing what STORM SYSTEMS were observed over the UNITED STATES and WESTERN ATLANTIC—*continued.*

Date of Observation. 1887.	Approximate Position of Centre of Depression.	Date when Report of Depression was received in London.		When estimated to be due off Coasts of N.Wn. Europe.	Depressions (causing Gales) which appeared on the Coasts of N.Wn. Europe.	Remarks.	Whether the Report was, or was not, received in time for use as Warning.
		Of an Uncertain character.	Of a Certain character.				
March.	Lat. N. Long W.	March.	March.	March.			
1st, Midt.	47° 88°	2nd	—	6th (Moving very fast.)	Did not arrive	Had the system reached us the "Certain" information would have arrived too late.	No.
2nd, „	44 65	3rd	7th				
10th, „	42 65	11th	16th	Uncertain. Movements very peculiar and irregular.	Did not arrive	- - - - -	No.
11th, Noon							
12th, „	42 62						
13th, „	42 55						
—	—	—	—	—	Large depression; reached W. of Ireland 21st, and a "V"-shaped subsidiary next day. Deep secondary system on 23rd. Gales very generally.	- - - - -	No warning.
21st, Noon	43 53	25th	27th	Uncertain; moving very rapidly.	Moderate (increasing) in N. on 26th. Gales in north.	Information received much too late.	No.
21st, Midt.	36 75	22nd	—	28th	Did not arrive	- - - - -	No.
22nd, „	- - -	23rd	—				
23rd, Noon & Midt.	45 68	—	25th&27th				
24th, Midt.	42 47	25th	30th	30th moving fast.	Small, but deep; off Nn. coasts on 30th, whence it moved S.Ewds.	The telegram conveying "Certain" information arrived too late."	No.

APPENDIX.

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
England, Thomas -	Barque Jane - -	636	P. Sutherland, Liverpool - -	One voyage to and from Apalachicola, one to Miramichi, and towards home to Lat. 47° N., Long. 44° West -	1885–86
Flinton, Benjamin -	Barque Dartmouth -	915	Merchant Shipping Co., Lim., London.	To and from Hong Kong - -	1885–86
[18] Frampton, Martin -	Barque Earlscourt -	1,113	W. J. Kidd, Liverpool - -	To and from Bassein - - -	1885–86
[18] Gordon, J. - -	S.S. City of Agra -	2,133	G. Smith, Glasgow - -	To and from Calcutta, viâ Suez -	1886
" " -	" -	"	" " - -	" " - - -	1886
[18] " " -	" -	"	" " - -	" " - - -	1886–87
[19] Graham, W. V. -	Majestic - -	1,884	T. and J. Brocklebank, Liverpool	To and from Calcutta - - -	1885–86
Gray, David -	S.S. Eclipse - -	435	D. Gray, Peterhead - -	To and from Greenland - -	1886
Gray, H. W. -	Pleione - -	1,072	Shaw, Savill, and Albion Co., Lim., London.	Home from Wellington - -	1886
Gray, John - -	S.S. Hope - -	450	R. Kidd, Peterhead -	To and from Greenland - -	1886
Hannay, Charles E. -	Prince Edward -	2,180	Robert B. Crowe, Liverpool -	To Monte Video, Chittagong, and home - - - -	1885–86
[20] Hawthorne, R. -	Barque Lord Wolseley	2,517	The Irish Shipowners Co., Lim., Belfast.	To and from Calcutta - - -	1885–86
Hayward, George Olive.	S.S. Dunrobin Castle -	1,797	Sir T. Brassey, M.P., Westminster	To Natal, Mauritius, Natal, and home -	1886
[21] Hepworth, C. M. W., F.R. Met.Soc.	S.S. Port Pirie -	2,049	W. Milburn, London - - -	To Cape Town, Sydney, Adelaide, and home, viâ Suez - - -	1886
Holdich, J. P. -	British Envoy - -	1,265	J. Coupland, Leicester - -	To and from Calcutta - - -	1885–86
Hood, William -	County of Edinburgh -	2,078	Robert Craig, Glasgow - -	To Bombay, Calcutta, and home -	1885–86
[22] Hoskyn, Commr. R. F., R.N.	Myrmidon - -	877	H.M.S. - - - -	Australian Station - - -	1885–86

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
[22] Hoskyn, Commr. R. F., R.N.	Myrmidon - -	877	H.M.S. - - - -	Surveying off Melbourne, Sydney, and Townsville - - - -	1886
[22] " " -	" - -	"	" - - - -	Surveying in Coral Sea, and off Townsville and Sydney - - -	1886
Houston, John -	Fort James - -	1,687	Robert Clark, Glasgow -	To Sydney, Newcastle (N.S.W.), San Francisco, and towards home to Lat. 36° S., Long. 27° W. - -	1885–86
Hughes, W. P. -	Laomene - -	1,746	D. Fernie, Liverpool -	To Calcutta, Mauritius, Calcutta, and home - - - -	1885–86
Irvine, J. W. -	S.S. Tunis - -	887	R. S. Donkin, Newcastle-on-Tyne	Two voyages to and from Alexandria -	1886
[23] Irving, P. J. -	S.S. Republic - -	2,187	Oceanic Steam Navigation Co., Liverpool.	Five voyages to and from New York -	1886–87
[24] Jones, Edward, R.N.R.	S.S. Ceylon - -	1,277	M. D. Lavin, London - -	To and from North Cape, and to and from Cronstadt - - -	1886
[25] Jones, S. Griff -	Barque Hermine -	538	T. H. Jackson, Liverpool -	To and from Vancouver Island -	1885–86
[26] Kennedy, C. W. -	S.S. Germanic -	3,150	Oceanic Steam Navigation Co., Liverpool.	Five voyages to and from New York -	1885–86
[26] " " -	" - -	"	" " " -	" " " -	1886
King, J. W. -	Philomene - -	1,423	D. Fernie, Liverpool - -	From New York to Calcutta and Hull	1885–86
Lailey, W. N. -	S.S. Boyne - -	1,306	Mercantile S. S. Co., Lim., London.	One voyage to and from Madras, viâ Suez, one to Genoa, Sulina, and home	1885–86
Leportier, T. -	S.S. Mira -	1,669	Star Navigation Co., Lim., Liverpool.	To and from Calcutta, viâ Suez -	1886–87
Luen, H. C. -	Barque Shakespeare -	767	E. C. Friend & Co., Liverpool -	To Wellington, Astoria, and home -	1885–87
Machugh, R. H. -	S.S. Ching Wo -	1,556	China Shippers Mutual Stm. Nav. Co., London.	To and from China, viâ Suez - -	1886
McLean, Archibald -	S.S. Concordia -	1,617	John Donaldson, Glasgow -	Five voyages to and four from Montreal	1886

LIST of DOCUMENTS, &c.—*continued.*

	Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
[27]	Maclear, J. F. L. P., R.N., F.R. Met.Soc.	Flying Fish	940	H.M.S.	Surveying in China Sea	1885–86
[27]	" "	"	"	"	Surveying off Port Darwin	1886
[27]	" "	"	"	"	Surveying in China Sea, and at Port Darwin	1886
	Marshall, Frederick	Wiltshire	1,461	Geo. Marshall, London	To Rio Janeiro, Chittagong, and home	1885–86
	Maxwell, Joseph	Oamaru	1,306	Shaw, Savill, and Albion Co., Lim., London.	To and from New Zealand	1886
	Melville, W. G. B.	Schooner Matabele	1,005	J. T. Rennie & Co., Aberdeen	To and from Natal	1886
	Meredith, John	Brigantine Meg Merrilies			From Suva to the New Hebrides, & back	1885–86
	" "	" "			From Fiji, to and from Solomon Islands, &c.	1886
[28]	Mesnard, Thomas	Sierra Miranda	1,808	A. M. Anderson, Liverpool	To Madras, Rangoon, and home	1885–86
	Metcalfe, J.	S.S. Oceanic	2,440	Oceanic Steam Navigation Co., Lim., Liverpool.	Between Hong-Kong, Yokohama, and San Francisco	1885–86
[29]	Miller, A. T., Nav. Lieut. R.N.	Conway	—	Training Ship	Off Birkenhead	1886
	Milne, W. F.	S.S. Esquimaux	466	Dundee Whale and Seal Fishing Co., Dundee.	To Newfoundland, Davis Straits, and home	1886
	Mitchell, George	S.S. Trinacria	1,466	T. Henderson, Glasgow	Gibraltar to New York and home. To Mediterranean Ports, New York, and home	1885–86
	" "	"	"	" "	To Mediterranean Ports, New York, and home. To Mediterranean Ports, New York, and back to Genoa	1886
[30]	Moore, Comr. W. U., R.N.	Rambler	835	H.M.S.	Surveying in China Sea	1886
[30]	" "	"	"	"	" "	1886
[30]	" "	"	"	"	" "	1886

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
Moss, M. T.	S.S. Inchulva	1,453	Robert Fraser, Liverpool	To and from Bombay, viâ Suez	1886
Murdoch, H.	Penthesilea	1,668	W. D. Reid, Liverpool	To and from Bombay	1885–86
Murdoch, Peter	Sierra Estrella	1,436	A. M. Anderson, Liverpool	To and from Rangoon	1886
Murray, Alexander	S.S. Perseverance	165	R. Kidd, Peterhead	To and from Cumberland Gulf	1885–86
Naile, Thomas	Barque River Ganges	642	Gavin B. Millar, Glasgow	To Townsville, Columbia River, and home	1886–87
New, George	S.S. Annie	1,247	J. Gray, Whitby	To Savannah (U.S.A.), and Bremerhaven. To New Orleans and Antwerp	1885–86
Norman, F.	Barque Polestar	625	J. Lyne, London	To and from Valparaiso	1886
North, W. G.	S.S. Tiger	510	Wilson & Sons, Hull	Trading between Hull and Hamburg	1886
" "	"	"	" "	Between Hull and Stockholm and Hull and Hamburg.	1886–87
Parry, Moses, F.R. Met.Soc.	S.S. Prydain	1,252	Prydain S.S. Co., Lim., Nevin	To Savannah, and Bremerhaven to Genoa; from Elba to Philadelphia and home	1885–86
" "	"	"	" " " "	To Savona, Baltimore, and Dublin. To Savona, Odessa, and Bristol. To Genoa, Palermo, and New York	1886–87
[31] Parsell, R.	S.S. Adriatic	2,458	Oceanic Steam Navigation Co., Liverpool.	Five voyages from and to New York	1885–86
[32] " "	"	"	" " " "	Six voyages to, and five from, New York	1886
Parson, G. F.	Earnock	1,198	W. Fraser, London	To Sydney, San Francisco, and home	1885–87
Pattman, Robert	Barque Loch Torridon	2,000	James Aitken	To Melbourne, San Francisco, and homewards	1885–86
[33] Pearson, C. W.	S.S. Strathleven	2,436	W. Burrell, Glasgow	Gibraltar to China, Japan, viâ Suez, New York, Savannah, and home	1886

LIST OF DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
Potter, Thomas -	S.S. Sulina - -	1,568	W. S. Bailey, Hull - -	One voyage to and from Sulina; one to and from Port Said; one to Port Said, and thence to Philadelphia - - - -	1885–86
„ „ -	„ -	„	„ „ - -	From Porman (Spain) to Philadelphia and Rotterdam. From Swansea to Baltimore and Rotterdam. To and from Cronstadt. From Antwerp to Boston - - - -	1886
Price, J. H. - -	Barque Viola - -	595	C. T. Bowring, Liverpool -	To and from Vancouver Island -	1885–86
Prout, John Cawse -	Cape St. Vincent -	1,422	A. P. Lyle, Greenock - -	To and from Singapore - -	1885–86
[34] Pullen, Lieut. and Comr. T. F., R.N.	Lark - - -	—	H.M.S. - - - -	At Sydney, Brisbane, and New Guinea	1885
Quaile, D. W. A. -	Orissa - - -	1,199	R. Kerr, Greenock - -	To Adelaide, San Francisco, and home	1885–87
Randall, W. -	Earl of Shaftesbury -	2,005	The "Earl of Shaftesbury" Ship Co., Lim., London.	To and from Calcutta - -	1886
Read, G. W., F.R.G.S.	S.S. Auretta - -	1,729	Auretta Steam Ship Co., Lim., London.	To Bombay, Moulmein, Bombay, and home, viâ Suez - - -	1885–86
[35] „ „ - -	„ - -	„	„ „ „ -	To Mediterranean Ports, Philadelphia, and Rouen - - - -	1886
[35] „ „ - -	„ - -	„	„ „ „ -	To Bombay, viâ Suez, Genoa, Odessa, and Antwerp - - -	1886–87
Renaut, Charles H. -	Pleione - -	1,092	The Shaw, Savill, and Albion Co., Lim., London.	To Wellington - - -	1885
Richardson, W. -	S.S. Circassian -	2,856	R. G. Allan, Liverpool - -	Towards Quebec - - -	1886
Ritchie, Alexander -	Four Winds - -	1,799	J. J. Gardiner, Liverpool -	To and from San Francisco - -	1885–86
Ross, Alexander -	Berbice - -	717	D. Kerr, Greenock - -	To Buenos Ayres, Java, and home -	1885–86

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
Ross, James -	S.S. Ben Alder -	1,331	W. Thomson, Jun., Leith -	To and from China and Japan, viâ Suez	1886
Rosseter, W. L. -	Barque St. Kilda -	865	A. T. Parker, Liverpool - -	To and from Demerara - -	1886
Russell, C. J. -	Khyber - -	1,967	Ralph Brocklebank, Liverpool -	To and from Calcutta - - -	1885–86
Sargent, A. H. -	Barque Glenlora -	774	Shaw, Savill, and Albion Co., Lim., London.	To Nelson (N.Z.), Valparaiso, Iquique, and home - - - -	1885–87
Scott, William -	Barque Commewyne -	315	J. Grierson, Glasgow - -	To and from Surinam - - -	1885–86
" " - -	" " -	"	" " - -	To and from Paramaribo - -	1886
Shearer, George -	Barque Thetis - -	1,294	A. Stephen, Dundee - -	To Adelaide, Astoria, and home -	1886–87
Sheldrake, J. W. -	Iron Cross - -	1,508	D. Fernie, Liverpool - -	To Rangoon, Calcutta, and New York -	1885–86
Simpson, Alexander	S.S. Australasian -	2,343	W. Henderson, Aberdeen -	To Cape Town, Melbourne, Sydney, Bombay, and home viâ Suez -	1885–86
" "	" -	"	" " -	To Melbourne viâ Cape Town, and home viâ Suez - - -	1886
" "	Barquentine Traveller -	196	A. Simpson, Peterhead - -	To Copenhagen, &c., Cumberland Gulf, and home - - - -	1886
" Smith, J. H. -	Worcester - -	—	Training Ship - - -	Off Greenhithe - - -	1886
Smith, W. C., F.R. Met.Soc.	Barque John R. Worcester.	844	John Stewart, London - -	To Newcastle (N.S.W.), Mauritius, Colombo, Cochin, and home -	1885–86
Spratly, W. - -	S.S. Mozart - -	1,304	Liverpool, Brazil, and River Plate Steam Nav. Co., Liverpool.	Antwerp to Rio Janeiro, Monte Video, New York, and Liverpool. Liverpool to Monte Video and Dunkirk -	1885–86
" " - -	" - -	"	" " "	Monte Video to Dunkirk. Liverpool to Monte Video, Marseilles, and home. Liverpool to Monte Video, and towards Antwerp - - -	1886
Stealey, John -	Barque Emily Waters -	446	G. S. Richardson, Swansea -	To and from Valparaiso - -	1886

LIST of DOCUMENTS, &c.—*continued.*

	Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
	Thomson, A. S., F.R. Met.Soc.	S.S. Buccaneer -	460	W. African Telegraph Co., London.	Cable laying off West Coast of Africa and home - - - -	1885–86
	,, ,, -	S.S. Silvertown -	3,724	The India Rubber, Gutta Percha, and Tel. Works Co., Lim., London.	To West Coast of Africa - -	1885
13	,, ,, -	,, -	,,	,, ,, ,,	To and from West Coast of Africa, and observations off the coast - -	1886
	Travers, H. D. -	S.S. Tartar - -	2,755	Union S.S. Co., Lim., Southampton	Three voyages to and from Cape Town	1885–86
36	Trott, Samuel, F.R. Met.Soc.	S.S. Minia - -	1,350	Anglo-American Telegraph Co., London.	At Halifax and other places in Nova Scotia - - - -	1886
36	,, ,, -	,, - -	,,	,, ,, ,, -	At Halifax, cable laying in North Atlantic, and home - - -	1886
	Trunks, H. - -	Barque Aldborough -	1,425	British and Eastern Shipping Co., Lim., Liverpool.	To Bombay and towards home, to Lat. 35° N., Long. 36° W. - -	1885–86
37	Wait, A. McLean, R.N.R.	S.S. Spartan - -	2,223	Union S.S. Co., Lim., Southampton	To and from Cape Town, &c. - -	1885–86
	,, ,, -	,, - -	,,	,, ,, ,, -	,, ,, ,, - -	1886
	,, ,, -	S.S. Trojan - -	2,285	The Union Steam Ship Co. Lim., London.	,, ,, ,, - -	1886
	Walker, Henry -	S.S. Cephalonia -	3,490	Cunard S.S. Co., Lim., Liverpool	Four voyages to and from Boston -	1885–86
	,, ,, -	,, - -	,,	,, ,, ,, -	Six voyages to and from Boston -	1886–87
38	Walsh, Maurice -	Barque Cottica -	319	Jas. Grierson, Glasgow - -	Home from Bombay - -	1886
39	Ward, J. - -	Pegasus - -	2,564	T. C. Wilkinson, Liverpool -	To and from San Francisco - -	1885–86
40	Waring, William -	S.S. Benalder - -	1,331	Wm. Thomson, jun., Leith -	To and from China and Japan, viâ Suez - - - - -	1885–86
41	,, ,, -	S.S. Breconshire -	1,648	D. J. Jenkins, London - -	,, ,, ,, ,, -	1886

List of Documents, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
[42] West, Frederick -	S.S. Port Adelaide -	1,783	Anglo-Australian Steam Nav. Co., London.	To Newcastle (N.S.W.) via Cape, Hong-Kong, Nagasaki, New York via Suez, and home - - -	1886–87
Wheaton, N. J. -	Barquentine Eliza -	299	J. H. Goodyear, Liverpool -	To Demerara, Barbadoes, Progresso, (Yucatan), &c., and home - -	1886
,, ,, -	,, -	,,	,, ,, ,, -	To and from Demerara - -	1886–87
Williams, H. -	Dynomene - -	1,900	D. Fernie, Liverpool - -	To and from Calcutta - - -	1885–86
Williams, H. H. -	Bankdale - -	1,308	Leslie C. Elmslie, Liverpool -	To and from Coquimbo - -	1885–86
Wilson, John -	S.S. Ethiopia - -	2,604	Barrow S.S. Co., Lim., Barrow -	Five voyages to and from New York -	1885–86
,, ,, -	,, ,, - -	,,	,, ,, ,,	,, ,, ,, -	1886
Wilson, William -	Barque Horsa - -	1,128	Star Nav. Co., Liverpool -	To Colombo, Cochin, and home -	1885–86
Youlden, H. -	Barque May Hulse -	468	J. Ransom, Southampton -	To Buenos Ayres, Talcahuano, and home from Coquimbo - -	1885–86
[43] Unknown - -	S.S. Maranoa - -	805	Queensland Steam Shipping Co., Lim., London.	London to Port Said - - -	1883

In cases distinguished by marginal numbers the Meteorological Registers were kept chiefly by Officers, as follows:—

[1] **Kept by Henry M. Lambert, R.N.R., 2nd Officer.**
[2] Kept by H. J. Blackburne, Chief Officer.
[3] Assisted by Messrs. Dawson, Lever, and Stanton.
[4] Kept by E. J. Evans, 2nd Officer.
[5] Kept by E. S. Yoxon, Mate.
[6] Kept by Douglas le Blond.
[7] Kept by William Kelso.
[8] Kept by M. J. Riva.
[9] Kept by Henry King Sturdee, Chief Officer.
[10] Assisted by H. G. Conolly, 2nd Officer.
[11] Kept by H. J. Blanchard.
[12] Kept by Lieutenant H. H. Douglas, R.N.
[13] Assisted by Officers.
[14] Assisted by W. H. Ross, 2nd Officer.
[15] Kept by Officers.
[16] Kept by C. J. Hall, 3rd Officer.
[17] **Kept by O. W. Read.**
[18] Assisted by D. Morrison and W. R. **More.**
[19] Assisted by 1st and 2nd Officers.
[20] Kept by Henry Hayes, 3rd Mate.
[21] Kept by J. L. V. Millett, 4th Officer.
[22] Kept by Sub-Lieutenant F. Bowden **Smith, R.N.**
[23] Assisted by J. Christie.
[24] Kept by E. J. Simmons.
[25] Assisted by Messrs. H. L. Calvert, **1st Mate, and** H. Dawson, 2nd Mate.
[26] Kept by C. Lancaster, 2nd Officer.
[27] Kept by Sub-Lieutenant W. O. Lyne, **R.N.**
[28] Kept by J. C. Glover.
[29] Kept by the Boys.
[30] Kept by Lieutenant Andrew Balfour, **R.N.**
[31] Kept by James B. Mackenzie, 3rd **Officer.**
[32] Kept by J. Christie, 3rd Officer.
[33] Assisted by Alexander Keith, 2nd Officer.
[34] Kept by Lieutenant George W. Gubbins, **R.N.**
[35] Kept by W. H. Richardson, 2nd Officer.
[36] Kept by *R. Ladd*, F.R.A.S., F.R. Met. Soc.
[37] Kept by George F. Weedon, 4th Officer.
[38] Assisted by 2nd Mate.
[39] Kept by R. S. Tipson, 3rd Officer.
[40] Assisted by Messrs. Henry Ward and Bolton, 2nd and 3rd Officers.
[41] Kept by Messrs. Lashbrooke and George **Cundy,** 2nd and 3rd Officers.
[42] Kept by W. H. Guy and D. E. Jamieson.
[43] Kept by C. L. Wragge, F.R.G.S., F.R. Met. **Soc.**

APPENDIX III.

Instruments supplied, &c. to the Royal Navy.

Per Account.	Barometers.	Aneroids.	Thermometers.				Hydrometers.
			Ordinary.	Max.	Min.	Screens.	
April 1st, 1886, afloat - -	191	397	1,215	203	163	119	134
Issued since - -	45	117	389	51	54	44	35
	236	514	1,604	254	217	163	169
Returned since - -	46	101	292	30	35	21	51
April 1st, 1887, afloat -	190	413	1,312	224	182	141	118

Instruments supplied, &c. for use at Naval Stations.

April 1st, 1886, in use -	79	110	259	18	30	7	20
Issued since - -	8	3	26	3	7	—	1
	87	113	285	21	37	7	21
Returned since - -	4	4	19	1	9	5	1
April 1st, 1887, in use -	83	109	266	20	28	2	20

Disposition of Admiralty Instruments on April 1st, 1887.

Afloat in Royal Navy - -	190	413	1,312	224	182	141	118
In use at stations - -	83	109	266	20	28	2	20
In store at M.O. - -	79	66	86	72	92	—	52
„ Chatham - -	3	1	14	4	4	2	4
„ Sheerness - -	6	6	20	5	4	2	9
„ Portsmouth -	6	14	45	13	13	18	8
„ Devonport -	4	5	22	4	4	1	24
„ Queenstown -	3	5	1	1	1	—	8
„ Gibraltar - -	1	4	2	—	—	—	4
„ Malta - -	8	11	46	7	7	1	18
„ Bombay - -	3	5	17	3	3	1	—
„ Halifax - -	4	10	28	5	6	—	14
„ Bermuda - -	6	10	34	2	4	—	15
„ Jamaica - -	2	1	11	2	2	—	—
„ Cape of Good Hope	5	10	27	8	7	3	31
„ Trincomalee -	3	1	12	2	3	—	—
„ Hong Kong* -	10	12	65	15	14	2	14
„ Coquimbo - -	3	6	17	3	2	19	—
„ Sydney - -	4	4	20	5	5	—	—
„ Esquimalt - -	3	4	5	2	2	—	—
Total, April 1st, 1887 -	426	697	2,050	397	383	192	339
Lost, &c. since April 1st, 1886	1	4	185	10	11	14	12
Under repair - - -	1	—	—	—	—	—	—

* To December 31st, 1886.

APPENDIX IV.

INSTRUMENTS supplied, &c. to Mercantile Marine.

Per Account.	Barometers.	Compasses.	Thermometers.				Hydrometers.
			Ordinary.	Max.	Min.	Screens.	
April 1st, 1886, afloat - -	139	—	774	1	1	142	403
Issued since - - -	98	—	626	—	—	89	323
	237	—	1,400	1	1	231	726
Returned since - -	99	—	610	1	—	90	306
April 1st, 1887, afloat - -	138	—	790	—	1	141	420

INSTRUMENTS at Stations, viz., Telegraph Offices, Observatories, Navigation Schools, &c.

April 1st, 1886, in use - -	113	4	283	66	61	38	25
Issued since - - -	*149	—	18	6	4	2	7
	262	4	301	72	65	40	32
Returned since - -	12	—	53	10	7	5	11
April 1st, 1887, in use - -	250	4	248	62	58	35	21

* Including 140 at Fishing Villages taken into this account.

DISPOSITION of Board of Trade Instruments on April 1st, 1887.

In merchant ships - -	138	—	790	—	1	141	420
In use at stations - -	250	4	248	62	58	35	21
In store at M.O. - -	44	1	270	13	38	45	78
At Liverpool Agency -	5	7	29	—	—	7	19
„ Aberdeen „ -	6	—	18	—	—	3	24
„ Glasgow „ -	6	—	18	—	—	2	4
„ Dundee „ -	13	—	52	—	—	13	42
„ Hull „ -	6	—	30	—	—	3	23
„ Southampton „ -	2	—	18	—	—	5	22
„ Cardiff „ -	3	—	17	—	—	1	7
Total, April 1st, 1887 -	473	12	1,490	75	97	260	660
Lost, &c. since April 1st, 1886	6	—	163	7	1	34	66

APPENDIX V.

List of Stations reporting Meteorological Observations by Telegraph to the Office on 31st March 1887, with the Names of Observers.

*†Sumburgh Head	Rev. W. Brand	Minister of Dunrossness.
*†Stornoway	D. MacDonald§	Late Officer S.S. "Great Eastern."
Wick	J. Sinclair	Watchmaker.
Nairn	Miss Penny	School mistress.
*†Aberdeen	J. McCormack	Telegraph Clerk.
Leith	W. Hay	Do.
*†Shields	J. W. Irvine	Do.
Spurn Head	J. B. Smith	Assistant Lightkeeper.
†York	H. M. Platnauer, F.G.S.	Curator of Museum.
Loughboro'	W. Berridge, F.R.Met.Soc.	
†Ardrossan	J. W. Mayes	Telegraph Clerk.
Malin Head	P. O'D. Farren	Signalman, Lloyd's.
*†Mullaghmore	K. Kerr	Retired Coastguard Officer.
*†Belmullet	Miss M. J. Tolan	Telegraphist.
†Donaghadee	T. MacGowan	Postmaster.
Parsonstown	B. Budds	Assistant Observer at Lord Rosse's Observatory.
Barrow-in-Furness	W. S. Whitworth	Engineer, Barrow-in-Furness Railway.
*†Holyhead	Capt. Richards	Keeper of Sailors' Home.
Liverpool	J. Hartnup, F.R.Met.Soc.	Bidston Observatory.
*†Valencia	J. E. Cullum	Superintendent of the Observatory.
†Roche's Point	W. Kennedy	Telegraph Clerk.
Pembroke	Messrs. Blake and Spicer	Lightkeepers.
*†Scilly	W. Thomas	Signalman.
Prawle Point	J. John‖	Coastguard Officer.
†Hurst Castle	G. G. Appleton	Lightkeeper.
†Jersey	J. Fisher	Signalman.
*†Dungeness	P. Curnow	Lightkeeper.
*†London	F. Gaster, F.R.Met.Soc.	Clerk, Meteorological Office.
Oxford	W. Wickham	Radcliffe Observatory.
Cambridge	H. Todd	Observatory.
*†Yarmouth	G. T. Watson	Secretary, Sailors' Home.
‡Hawes Junction	W. H. Bunce	Station Master.

Note.—Those stations marked with an asterisk (*) report also at 2h. p.m.; and those with a dagger (†) at 6h. p.m.

‡ This station now reports by post only.

§ Mr. MacDonald died on 12th March 1887; Mr. J. Forbes of Nicolson Institution took charge of the instruments on 21st of May.

‖ Since removed to another C. G. station.

APPENDIX VI.

Report of the Inspection of the Irish and Welsh Stations.

Gentlemen,

I have to report that I have completed the inspection of these stations, with the exception of four of those which furnish information for the Weekly Weather Report, viz., Foynes, Kilkenny, Killarney, and Llandovery, which were not considered to require visiting this year.

The stations of Malin Head and Londonderry were visited by Captain Toynbee.

Telegraphic Stations.

Holyhead, visited September 16.—I found that the rain-gauge and thermometer screen were too much overshadowed by shrubs, and directed the observer to have the necessary alterations effected. The station otherwise was in good order. I took down one of the new hand anemometers to this station and instructed the observer in its use.

Donaghadee, visited September 21.—This station was, as usual, in good order, and calls for no remark.

Mullaghmore, visited September 23.—The only defect I discovered at this station was that the index of the minimum thermometer was occasionally left partially dry, so that the indications were incorrect. A new instrument is to be supplied.

Belmullet, visited September 25.—The reports from this station have shown a marked improvement during the last twelve months. A weathercock has been erected, so that the reports of wind direction have been more correct.

Malin Head, visited by Captain Toynbee, July 1.—This station is not perfectly satisfactory, as the reporter, Lloyd's signalman, frequently reads the barometer incorrectly. His brother, who is Lloyd's agent, does the work correctly, but he lives at a distance from the Signal Tower, and so cannot give constant attention to the reports. We must endeavour to effect an improvement by correspondence.

Parsonstown, visited September 30.—This station was satisfactory, as usual.

Roche's Point, visited October 4.—There is nothing particular calling for remark at this station.

Valencia, visited October 6.—The telegraphic reporting duty at this station is satisfactory, except that the observer does not furnish very full cloud reports.

St. Ann's Head, visited October 11.—This station is quite satisfactory, excepting that tourists have again been interfering with the instruments. I have had to direct that a wire cover should be placed over the sunshine recorder.

Weekly Weather Report Stations.

The stations of Edgeworthstown (Currygrane), and Waterford (Brook Lodge), were visited September 28 and October 8 respectively; they were both in good order. At the latter station Mr. Bolton the observer was unfortunately absent on the day of my visit.

STATIONS OF THE SECOND ORDER.

Armagh, visited September 22.—The thermometers and rain-gauge have been removed to their new site in the enclosure on the south side of the observatory since the date of my last visit. This is a decided improvement.

Dublin (*Fitzwilliam Square*), visited September 20.—The station remains as satisfactory as is possible for the locality.

Dublin (*Glasnevin*), visited September 20.—At this station the thermometer screen and rain-gauge have been slightly moved. The instruments, &c. are in good order.

Dublin (*Mountjoy Observatory*), visited September 20.—The only matter calling for notice at this station is that the wind reports are unsatisfactory. The instrument is a small anemometer, its indications (means per hour), are converted by James' Table to pressures per square foot, and these again to the figures by Beaufort's scale, with the result that the force reported is much too low. I would recommend that a self-recording instrument be supplied.

Colebrooke, visited September 23.—This station calls for no special remark.

Parsonstown, visited September 30.—See Report above.

Markree, visited September 24.—This station continues in very good order.

St. David's, visited October 9.—At this station the thermometers and rain-gauge have been removed to a fresh site, much more open than that previously available. This station is in very good order.

Londonderry, visited by Captain Toynbee June 30, and found to be in a satisfactory condition.

OBSERVATORY.

Valencia, visited October 6.—There is nothing calling for remark.

The following table shows the results of thermometric comparisons:—
Corrections to be applied to the readings of—

STATIONS.	Dry Bulb.	Wet Bulb.	Max.	Min.	Spare Therm.	Remarks.
STATIONS OF THE SECOND ORDER.						
Armagh	−0·3	−0·2	−1·1	—	−0·5	
Parsonstown	−0·3	0·0	−0·4	0·0	—	
Brookborough	−0·8	−0·6	−0·4	−0·5	—	
Dublin (City)	−0·4	−0·4	−0·5	0·0	−0·5	
Dublin (Phœnix Park O.S.O.)	−0·2	−0·4	−0·2	+0·5	—	Grass min. −0·1.
Glasnevin	−0·3	−0·5	−0·5	+1·3	—	Do. do.
Markree Castle	0·0	0·0	+0·1	+0·1	—	
St. David's	−0·6	−0·6	−0·2	−0·6	—	Do. −0·4.
Londonderry	−0·4	−0·4	−1·6	−0·2	—	
TELEGRAPHIC REPORTING STATIONS.						
Belmullet	−0·4	−0·4	−0·1	−0·3	—	
Donaghadee	−0·5	−0·7	−0·1	−0·2	—	
Malin Head	−0·4	−0·5	−0·8	−1·8	−0·6	
Mullaghmore	−0·2	−0·2	−0·1	+0·2	−0·3	
Valencia	−0·7	−0·6	−0·9	+0·4	−1·0	
St. Ann's Head	−0·6	−0·2	−1·2	−0·3	−0·7	
Holyhead	−0·2	−0·3	−0·4	−0·2	−0·3	
WEEKLY WEATHER REPORT STATIONS.						
Edgeworthstown	−0·3	−0·3	−0·3	+0·1	—	Grass min. +0·4.
Waterford	−0·6	−0·6	−0·6	−0·2	—	Do. do.

Yours, &c.
(Signed) ROBERT H. SCOTT.

Report of the Inspection of the English Stations.

I have the honour to submit the following report of the stations in England inspected by me this year.

Telegraphic Reporting Stations.

Jersey (*Noirmont*), June 23.—The observations are excellently conducted at this station, and the instruments are all in good order. I removed the sunshine recorder to this station on April 18.

Hurst Castle, July 3.—The observations at this station are fairly good, but the direction of the winds reported is not reliable. The very high maximum temperatures occasionally reported have been I think due, principally at least, to the extreme mobility of the index column of the maximum thermometer, coupled with a certain amount of unskilfulness in the observer. A new maximum has therefore been sent to this station on the 3rd of August.

The barometers are in good order. I removed them to a position a few yards from that which they have hitherto occupied, in order to obtain a rather better light, and to avoid the afternoon sunshine.

The thermometer screen required repainting and some repairs, about which directions were given.

Dungeness, July 6–9.—The work done at this station has been in several respects unsatisfactory. The light-keepers, four in number, take the readings of the instruments in rotation when on duty, as mentioned in last year's report. They are as yet by no means careful observers.

The low minima of temperature often reported did not appear to me to be attributable to volatilization or to interruption of the thread of spirit in the thermometer, which is a good instrument, but to carelessness, sometimes in reading, and at other times in setting the instrument.

The barometer No. 619, had been moved into the tower by one of the observers, Mr. Curnow. I hung the other barometer, No. 618, by the side of it.

It will be seen in the table that the difference of the readings of the two instruments is rather large. Both the tubes are free from air.

The wet-bulb was much crusted. The remaining instruments were in good order.

Yarmouth, July 12.—I found the instruments at this station in good order, and well attended to, as usual.

I took down to this station a small self-registering anemometer.

The large anemometer was in good order.

Loughborough, July 14.—The observations at this station was exceptionally good, and I found all the instruments in perfect order. I experimented with a small self-registering anemometer in the observer's garden, the estimated wind force being 4 at the time, with unsatisfactory results.

Spurn Head, July 16.—The barometric reports from this station have still appeared to be somewhat low, and this may possibly be due to the observer having set the vernier too low.

The instruments were all in very good order. The great drawback in the instance of this excellently exposed station is the sand-drift. The sand almost constantly coats the wet-bulb, and during the time that I removed the thermometers for comparison (about 80 minutes) the wind, then blowing with the estimated force 4, had filled with sand every interstice in the closed screen, from which I had previously swept the sand. In rainy weather much wet sand occupies the funnel of the rain-gauge.

For wind reports the great superiority of this station over others on our east coast is unquestionable.

York, July 18.—Some improvement is shown in the observations at this station, and the observer reads and reduces correctly. The rain-gauge had now become quite useless, and it had become necessary to employ that which is used for the 9 o'clock observations.

The barometer is now in good order.

North Shields, July 21.—The instruments, with the exception of the small self-registering anemometer (which was out of order), were all in good order, and the observations are, as usual, well attended to.

Barrow-in-Furness, July 26.—Everything at this station appeared to be in good order. The barometer is sluggish, but contains no air.

Scilly (*St. Mary's*), September 25–27.—I took to this station the self-registering aneroid which was sent back last year for repairs. I left it in good working order, having adjusted it to the mercurial standard, but the clock required a little further regulation.

All the instruments were in excellent order.

The anemometer worked well at the date of inspection. It is a difficult matter to attend to this instrument during a southerly gale with rain, and the observer asks for the erection of some shelter, such as a sheet of galvanized iron with light boardings on the steps of the pillar, but I believe that this would, in all probability, seriously interfere with the motion of the air striking the cups.

Prawle Point, September 28.—The observer, Mr. J. John, was absent on leave at the date of my inspection, and the chief boatman, Mr. McLegen, took the readings, reading the barometers with precision, but the thermometers a little too high. The instruments were all in good order, except that the rain-gauge, which is attached to an extremely firm block, required raising on the south-east, and that the wet-bulb was not quite clean. A very careful look-out for weather is maintained at this station.

Stations of the Second Order and Weekly Weather Reporting Stations.

Southampton, July 2.—Everything appeared to be in good order, as usual, at the station except that the sunshine recorder (which has a perfect exposure) required a trivial alteration. The maximum appears to give rather high and the minimum rather low readings.

St. Leonard's, July 10.—The station is now an exceedingly good one, the positions of the instruments being admirable. I ascertained, first from barometrical comparisons and secondly by levelling, that the cistern of the barometer is 31·5 feet above an Ordnance mark, which is itself 114·3 above M.S.L. The barometer cistern is thus 145·8 above M.S.L.

Epsom (*Royal Medical College*), July 11.—This is a new station, which promises well. The returns at the date of my inspection were slightly incomplete, and some reduction errors were noticeable, but great improvement may be anticipated. The Stevenson's screen and rain-gauge have a complete exposure, being in a large lawn on the front or north-west side of the College. There is a gentle fall of the ground towards west-north-west. The outdoor instruments are 272 feet above M.S.L., and the cistern of the reporting barometer 304 feet. The instruments were all in excellent order.

The station appears to be fairly well situated for observations of the wind, but is slightly sheltered from Easterly winds by the Downs.

Geldeston, July 12.—A larger screen was, on January 1st, 1885, substituted for the Stevenson's previously in use at this station, details

of previous comparative readings in the two screens being sent to the Meteorological Office. The instruments at this station, including thermograph, barograph, &c., were, as usual, in excellent order. The sunshine recorder required a slight adjustment, the slate by which it was supported on the south-east having been partially displaced.

Leicester, July 13–14.—At this station, the instruments were found to be in tolerably good order. The observer is painstaking, but he fails to read the instruments with complete accuracy. A new grass minimum had been employed since the 10th of July; its readings are somewhat low. The wind-force was over-estimated by the observer on the 14th. The sunshine recorder required re-adjustment.

Sheffield, July 15.—The instruments at this station are most carefully attended to, and the returns are very accurate and full, but it has hitherto been impossible to obtain readings at 9 instead of at 6 p.m. The buildings on the west of the out-door instruments, prospectively alluded to in my last year's report, are now in course of erection, but are not likely to be completed before May 1887. In the meantime it is not certain where the new gravel walks will be laid down, and the instruments have therefore not been shifted. The general exposure in the park is excellent, but for the present the screen and rain-gauge are somewhat sheltered by building sheds. The readings of two earth thermometers are now taken at 9 a.m. There is some hope that when the new Art Gallery is completed, the anemometer, which is now at the Borough Hospital, may be transferred to the Museum, where it could be regularly attended to. The station is altogether an excellent one.

York, July 17–18.—The observations are fairly good. The Bootham Friends' School, on the ridge of the roof of which the sunshine recorder is erected, was closed for the holidays, and I could not learn by whom the cards were now attended to. The instrument was correct as regards level, but quite out of adjustment as regards time. It is erected on a very high thin framework of wood attached by six wires to surrounding chimney-tops, and is by no means easy of access, still less of adjustment.

Whitby, July 19.—The observations at Whitby Lighthouse were commenced at the beginning of 1886. They are conducted very efficiently by Mr. Powell, whose daughter also in his temporary absence takes the observations well. The lighthouse and buildings have the sea on the north-east and are situated close to the edge of the cliff, which is here nearly perpendicular. The barometer cistern is 203 feet above M.S.L. The thermometer screen, which is a Royal Meteorological Society screen, and the rain-gauge, have a complete exposure in the garden to the south-west of the lighthouse. A few hundred yards to the west, the ground rises with a somewhat steep incline to a level of about 65 feet above the garden, while to the north and north-west, there is also a rise of 50 feet or more. Winds from West and North-west will consequently be felt at the station itself with diminished force. The existing instruments were all in excellent order, and the station promises to be a useful one.

Durham, July 20.—Since Mr. Carpenter's appointment, the observations have been very efficiently taken at 9 a.m. and 9 p.m. In March 1886 the rain-gauge had to be slightly lowered, but the instruments are otherwise unchanged. The thermometers read very correctly, but I have not the slightest doubt that the nature of the screen causes the readings to be too high, perhaps by as much as a degree. The observer is most careful and attentive.

Seaham, July 20.—On June 1, 1886, a complete change was made in the position of the outdoor instruments. They were removed into

the south-east corner of the large new cemetery ground, which is distant between 800 and 900 yards from their former site, and is at a somewhat greater elevation. The change of position was most desirable, as the instruments have now a true exposure. They were in fairly good order, but the maximum thermometer read 0°·6 too low, an error which if the corrections since supplied to the observer were employed, would amount to 0°.9. Mr. Aird promised me to have the screen at once painted with a light colour. It was painted green in 1885, as mentioned in that year's report.

Penrith (*Newton Observatory*), July 22.—This is an admirably equipped station, and all the instruments, including barometers, anemometer, sunshine recorder, thermograph, and self-registering aneroid were in excellent order. The thermometer screens and rain-gauges have complete exposure. The returns are very full and correct, Mr. Benn was absent at the time of my visit. His assistant, Mr. Rownsey, took the readings very correctly.

Cronkbourne (*Isle of Man*), July 25.—I found all the work at this station in its usual unexceptionable condition. The instruments are in excellent order, the observations carefully taken and fully reported.

Douglas (*Isle of Man*), July 25.—This is a new station. The observer, Mr. T. Keig, appears to be careful and painstaking, and the thermometers are good instruments. The screen is a wall screen, and the boarded flooring which surrounds it is unfavourable for the observations of temperature. The screen is also single louvred. The observations here taken are, I believe, locally published as indicative of the climatology of Douglas. I should say that, on the average, the temperatures reported would be 2°·5 too high. The rain-gauge, like the thermometer screen, is on a portion of the roof, and has a most indifferent exposure. The barometer, an ordinary Fishery barometer, stands in an adjoining room, and its cistern is 56 feet above M.S.L. The house is in the middle of the town on a considerable slope.

Plymouth, September 23.—I again inspected this Weekly Weather Reporting Station, since on the 1st of January 1887 Dr. Merrifield intends to commence reporting from his new house in Hobart Terrace, and it seemed desirable to report on the nature of the new sites for the instruments. These will be very good, and the rain-gauge especially will have a true exposure, instead of being much sheltered as at present on the south-east. The sunshine recorder will also have an almost if not quite, perfect exposure.

I found the instruments in good order as on all former occasions.

Helston, September 24.—At the date of my visit the last sheet returned from this station was that for September 1883. The observer continues to be in rather weak health, and somewhat overworked in his profession as a schoolmaster. He is desirous of obtaining the assistance of the Meteorological Office in some of the reduction work.

Arlington Court (*near Barnstaple*), September 29.—The situation of the out-door instruments is good, and the thermometers and rain-gauges are in good order. The barometer is unfavourably placed and is not very accurate.

Chatham, October 14.—The observer was absent at the date of my visit. One of the deputy observers took readings with me correctly. The barometer and thermometers (excepting the minimum, which had 2° of spirit detached which had been unnoticed) were in fairly good order. A new screen is absolutely necessary, and has been ordered. The old Stevenson screen is falling to pieces, and a screen recently sent down to the station is of an obsolete kind and is rejected.

In the last column of the table appended to this report the letters A, B, and C indicate what I consider the quality of the observations taken at the stations, with no reference to the correctness or want of correctness of the instruments employed. A signifies that adequate care is taken by the observers, and that the station is a satisfactory one; B that the observations as taken are not quite satisfactory; C that the present state of the observations taken is unsatisfactory.

(Signed) W. CLEMENT LEY.

October 15, 1886.

BAROMETER and THERMOMETER READINGS, STATIONS in ENGLAND.

Station.	Reporting Barometer.	Difference of Observer's from Inspector's Readings.	Check Barometer.	Dry Bulb.			Wet Bulb.			Maximum.			Minimum.			Spare.			Condition of Station.
				Temp. in Water.	Correction to reduce to Inspector's Standards.	Correction as applied or supplied.	Temp. in Water.	Correction to reduce to Inspector's Standards.	Correction as applied or supplied.	Temp. in Water.	Correction to reduce to Inspector's Standards.	Correction as applied or supplied.	Temp. in Water.	Correction to reduce to Inspector's Standards.	Correction as applied or supplied.	Temp. in Water.	Correction to reduce to Inspector's Standards.	Correction as applied or supplied.	
Arlington	29·56	+·02		58·1	+0·3		58·1	+0·3	−0·3	58·0	+0·4		57·4	+1·0					C
Barrow-in-Furness	29·503	−·005		58·8	+0·2	−0·4	59·0	0·0		58·7	+0·3	−0·1	58·8	+0·2	−0·1				A
Chatham	29·614	·000		56·3	0·0	+0·1	56·2	−0·9	−0·8	55·3	0·0	0·0	56·2	−0·9	−0·7	55·3	0·0	0·0	C
Cronkbourne	29·442	·004		60·8	−0·1		60·9	−0·2		60·8	−0·1	+0·1	60·5	++0·2	+0·4	60·3	+0·4		A
Douglas	29·608	·002		63·0	−0·1	0·0	62·9	0·0	−0·1	63·0	−0·1	−0·6	62·8	++0·1	−0·3				B
Dungeness	30·092	·018		64·5	+0·1		64·4	+0·2		64·3	+0·4		64·6	0·0					B
Durham	29·689	·001		59·9	0·0	0·0	59·9	0·0	0·0	59·9	+0·4	+0·1	59·5	+0·4	+0·5	59·9	0·0		C
Epsom	29·818	·002		62·1	+0·1	−0·1	62·0	+0·2	0·0	62·0	+0·2	0·0	62·2	0·0	−0·1				A
Geldeston	29·949	·000		59·9	0·0	−0·1	60·0	−0·1	−0·1	59·9	0·0	0·0	59·4	++0·5	−0·1	60·0	−0·1	0·0	A
Helston	30·092	·000		55·0	−0·1		54·9	0·0		54·8	+0·1	−0·2	54·4	++0·5	−0·1				B
Hurst Castle	30·417	·001		64·4	+0·3		64·8	−0·1		64·4	+0·3		65·5	+1·3	+1·0				B
Jersey, Noirmont	29·803	·000		57·6	0·0		57·9	−·03		57·4	+0·2		57·2	+0·4					B
Leicester	29·834	·004		59·3	0·0		59·1	+0·1		59·1	+0·1		58·7	+0·5					A
Lowestoft	29·440	·000		56·8	−0·1		56·7	+0·1	0·0	56·4	+0·3	0·0	56·3	+0·4	0·0				A
Newton (Penrith)	29·005	·005		60·3	0·0		60·3	0·0		60·3	0·0		60·0	+0·3					A
Plymouth	—	—		—	—		—	—		56·6	−0·5		55·1	+1·0					A
Prawle Point	29·860	·000		57·9	−0·1		57·8	0·0		58·0	−0·2	0·0	57·7	+0·1					A
St. Leonards	—	—		58·1	0·0		58·2	−0·1		58·0	+0·3		58·8	+0·3					A
Scilly, St. Mary's	30·200	·000		57·7	+0·2		57·9	0·0		57·8	+0·3		57·8	+0·1		58·9	+0·2	0·0	A
Seaham	29·968	·000		58·7	−0·2	0·0	58·6	−0·1	−0·3	58·6	0·0		58·5	+0·5		58·9	−0·1		A
Sheffield	29·336	·002		59·8	0·0		60·0	−0·2	−0·1	59·8	+0·2		59·8	+0·5					A
Shields, North	29·860	·000	29·846	63·4	−0·1		62·8	+0·1		63·0	+0·1		63·0	+0·3		63·4	−0·1		A
Southampton	30·333	·000		66·4	+0·2		66·5	0·0		66·2	+0·4		66·2	+0·4					A
Spurn Head	29·701	·004		60·3	−0·2		60·1	0·0		60·1	+0·2		60·2	−0·1					A
Whitby	29·596	·001		59·2	−0·1		59·1	0·0	−0·1	59·0	+0·1	+0·1							A
Yarmouth	29·960	·008		62·5	+0·1		62·9	−0·3		63·1	−0·1		63·1	+0·5					B
York	29·833	·001		60·2	0·0		60·2	0·0		60·5	−0·3		59·9	+0·3					B
York (2nd Order)	29·833	·001		60·2	0·0		60·2	0·0		60·0	+0·2		60·1	+0·1					B

Report of Inspection of the Scottish Stations.

Barometers.

I did not take with me this year a mercurial standard barometer. As in previous years the aneroid No. 11 was read with the barometers of the stations, with, however, the same experience, viz., that aneroids are of little, if any, use as a control instrument for inspection purposes. The result of the inspection and a comparison of the barometric readings with the isobars of the weather charts warrant me in saying that the barometers at each of the stations continue to be in excellent order.

It is gratifying to report that the difference between the inspector's and observer's, or assistant's, readings in no case exceeded 0·002 inch.

Thermometers.

In comparing the thermometers, inspector's standard thermometer No. 2,522 was first used, but this having been unfortunately broken, the standard thermometer No. 2,395 was thereafter used. The results of the comparisons made with these standards and the thermometers at the different stations and at Aberdeen Observatory are shown in the following table, the readings of the standards being corrected for instrumental errors, but the thermometers at the stations are uncorrected:—

Stations.	Standard No. 2,522, Corrected.	Station Thermometer.					Time in Water in Minutes.	Change of Temperature of Water.	Notes.
		Dry	Wet.	Spare.	Max.	Min.			
	°	°	°	°	°	°		°	
Landale -	55·2	+0·1	+0·1	—	+0·1	−0·3	90	−0·2	
Stornoway -	57·8	+0·6	+0·5	+0·3	−0·5	−0·5	100	Uniform	
Swanbister -	59·8	0·0	+0·1	+0·4	0·0	−0·2	180	−0·2	
Dunrossness	55·0	+0·3	+0·3	+0·2	+0·1	−0·8	135	Uniform	
Wick - -	56·9	+0·3	+0·3	—	−0·3	−0·1	60	+0·2	
Dunrobin -	61·8	−0·4	−0·6	—	+0·5	−0·6	95	−0·2	
Nairn -	55·1	+0·6	−0·7	+0·1	−0·2	+1·0	110	Uniform	
Aberdeen -	53·1	+0·2	+0·4	—	−0·5	0·0	150	Do.	
Braemar	52·7	+0·4	+0·5	—	+0·5	−0·1	95	+0·5	
Dundee -	53·1	+0·5	+0·5	—	+1·3	- 0·2	80	Uniform	
Pinmore -	54·8	+0·3	+0·5	—	−0·1	0·0	45	+0·2	
Ardrossan -	53·4	+0·3	+0·4	—	0·0	−0·3	90	+0·2	
Rothesay -	55·5	−0·1	−0·1	—	−0·1	−0·4	75	Uniform	Min. 1st, 53°·9, 2nd, 54°·4.
Glenalmond	54·6	+0·2	+0·3	−0.2	+0·3	−0·2	85	Do.	
Leith - -	52·9	+0·1	+0·5	—	0·0	−0·4	60	Do.	
King's College.	52·0	+0·1	−0·1	—	+0·2	+0·1	30	Do.	Stevenson's screen Thermograph.
Aberdeen -	52·0	−0·3	+0·3	—	+0·2	−0·3	80	Do.	

Hygrometers.

Readings were taken of the dry and wet bulb thermometers immediately on opening the thermometer screens, which indicated that the instruments are kept in good order at the stations. The greatest differences, about 7°·0, occurred at Landale, Wick, Dunrobin, and Braemar; and the smallest, about 1°·0 at Pinmore, Ardrossan, Rothesay, and Glenalmond, the weather on these occasions being close and dull.

Notes on the Stations.

Laudale, August 17.—The register for the last twelve months was carefully gone over, with the result that the observations appeared to be made and entered with care. While Mr. Fletcher was making the

observations on the morning of Sunday, previous to my visit, during a strong wind, a sudden gust of some violence occurred, which blew down the minimum thermometer and broke it. A new one had been ordered from London. On the same morning several large ricks of hay were blown into the sea and totally lost. All the instruments were in very good order.

Stornoway, August 23.—The assistant read the instruments and made up the weather telegram correctly. The barograph is carefully attended to and works well. The Stevenson's screen and tall pole on which the sunshine recorder is placed had been re-painted the week before my visit, and all the instruments were in excellent order and well observed.

Swanbister, August 25.—This station was established in the end of 1885, in the place of the station at Sandwick, so long superintended by the late Dr. Clouston. Excellent positions have been secured for the anemometer, the thermometer screen, and the rain-gauge; and these instruments were all in very good order, and observed with much intelligence, and great interest was manifested in the work.

Mr. Fortescue, when at home, makes the observations himself, but otherwise they are made by one of the three assistants he has carefully trained. The observations of two of these assistants, I had an opportunity of examining, and in each case the readings of the barometer and thermometer were exactly the same as my own readings.

Dunrossness, August 27-28.—Miss Brand is being trained as a second assistant at this station. All the instruments were in excellent order and well observed.

I handed over to Mr. Brand the small dial anemometer with a two-minutes sand-glass attached, designed to show from a two minutes observation the rate of the winds velocity per hour. Mr. B. readily understood the instrument, and during my visit numerous observations were made with it. The force of the wind during the first observation was estimated by Mr. B. at 4, and the instruments recorded a rate of 24 miles an hour, which a subsequent examination of the table, p. 58 of *Instructions in the use of Meteorological Instruments*, showed to be a very close approximation.

A number of observations were made as to the number of seconds which elapsed as each mile rate was recorded. The results showed the wind to be more unsteady in force than might have been supposed. On one occasion the following were the minutes which elapsed from mile to mile as marked on the dial, 14, 9, 10, 9, 9, 11, 14, 11, 7, 8, and 14, the mean being 10½ miles.

Wick, August 31.—The instruments were all in very good order, and the observations were made intelligently and with care. The barometer was read correctly by the assistant.

Dunrobin, September 1.—With the exception of a slight deformation of the rain-gauge, the instruments were in good order and carefully observed.

Nairn, September 6 and 14.—Since last inspection, Mr. Penny, the observer for many years, has died, and his daughter, Miss Penny, has been appointed successor. The instruments were in very good order, and the observations made intelligently and accurately. Miss Penny is assisted by her brother and sister, who both read the instruments correctly, and the brother can also make up with despatch and correctness the weather telegram. Each of the sisters makes the observations independently, and compares them before making up the daily telegram.

A considerable additional breadth of the wood has been cut down since last year, and the station is now, except for a narrow strip to the westward, well cleared of the wood.

Aberdeen, September 24.—The rain-gauge was not quite circular, but was put right. The other instruments continued to be kept in excellent order, and observed with much intelligence.

Braemar, September 27.—A Jordan's sunshine recorder, the gift of G. P. Wragge, Esq., Birmingham, has been added to this station since last inspection. It is very well placed to receive the sun's rays at all seasons. The instruments were in very good order and well observed.

Dundee, September 28.—The instruments were all in good order and were observed correctly.

Pinmore, September 30.—The instruments were in excellent order. Both Mr. Donald and his son, who assists in reading the barometer when required, were from home at the time of my visit. The apprentice gardener, who occasionally observes the temperatures and the rainfall, read all these instruments correctly and understands their manipulation.

Ardrossan, September 30.—The thermometer screen, which is again greatly in need of painting, was ordered to be re-painted and generally repaired. The other instruments were in good order and very intelligently and carefully read. The spare barometer will be removed to Mr. Mayes's new house when the height has been ascertained.

Rothesay, October 1.—A new pole, 47 feet high, was erected in the beginning of the year for the vane, which works quite freely. The instruments were in good order, and the observations are made with care and intelligence.

Glenalmond, October 9.—With the exception of the minimum thermometer, the instruments were in excellent order and the observations made with great accuracy.

Leith, October 13.—A new ventilator is required for the thermometer screen, and the screen itself needs to be painted. The other instruments were well kept, and the observations faithfully and carefully made.

The Observatory, King's College, Aberdeen, September 25.—All the instruments, both of the Observatory proper and the Stevenson's screen with the thermometers in the garden, were found to be in excellent order, and the observations made with the greatest care and with much intelligence.

ALEXANDER BUCHAN.

REPORTS ON INSPECTIONS of the OBSERVATORIES, &c., 1886.

Aberdeen, visited August 17-20.—The instruments at this observatory were found carefully tended and all in good order. The barograph and thermograph had their lenses, clocks, and fittings cleaned. A new ratchet spring was fitted to the clock of the latter instrument. The thermometers were all compared both with the Kew standard No. 642, and in melting ice, and their corrections at 32° found to be as follows:—

Dry standard - - -	−0°·6
Wet standard - - -	0·0
Maximum M.O. No. 48 - -	−0·5
Minimum No. 5050 - -	−0·3

The anemograph was examined and cleaned and found to be in good order both externally and internally, with the exception of the fans of the direction vane. These are completely worn out and new ones required. I took a pattern of the worn shaft so that new fans may be supplied of the right size. The Beckley rain-gauge was found to be in good order throughout, but the measuring glasses of both the Beckley and the 8-inch gauges are broken and new ones are needed.

Glasgow, visited August 27–28.—The barograph and thermograph were examined and cleaned as usual. The gas-burner of the dry-bulb thermograph was slightly varied so as to enable the zero hole of the screen to be illuminated and its image traced upon the cylinder. The thermometers were compared with the standard, and their corrections found to be as follows :—

Dry standard - - -	−0°·1
Wet standard - - -	−0·4
Minimum - - -	+0·2
Maximum - - -	+0·1

The anemograph was cleaned and examined, the screw thread on the fan shaft was found to be very much worn away and the teeth of the worm wheel much cut in places. This wheel was taken off and refitted 120° from its former position, in order to expose a new part of its circumference to the most severe wear.

The Beckley rain-gauge was in good order, and working satisfactorily.

Stonyhurst, September 4.—All the instruments were examined and found to be in good order, the action of the thermograph light-shutter was not quite satisfactory, but was improved.

The thermometers were compared and found to require the following corrections :—

Dry Standard - - -	−0°·1
Wet Standard - - -	−0·3
Maximum No. 439 - -	−0·2
Minimum No. 501 - -	+0·1

Radcliffe Observatory, September 11, 1886.—The instruments lent by the Meteorological Council to the Radcliffe trustees were found to be all in excellent order, but the photography was in a most unsatisfactory condition; this had been the case for some time. The last supply of paper procured through the Kew Observatory, although apparently of the highest quality and very carefully prepared, has proved most unsatisfactory from a photographic point of view. It is presumed that some foreign ingredient of a deleterious nature has been introduced either into the texture of the paper or the composition of the wax, although both were procured from the best known makers. These have been applied to, but are unable to assign any reason for the failure.

The following were found to be the corrections for the various thermometers in use :—

Standard, dry bulb - -	−0°·2
„ wet „ - -	−0·2
Maximum, M.O. 356 - -	−0·4
Minimum, M.O. 363 - -	0·0
B.T.. 1,710 - -	−0·5
B.T. 1,709 - -	−0·3

ANEMOGRAPHS.

Swanbister, Orkney, August 23 and 24.—This instrument, which had formerly been at Sandwick was removed to this station in December last by Mr. Boswell, of Aberdeen. Owing to the extremely inclement weather at the time, he was quite unable to give the instrument the thorough overhauling and cleaning which it required. I accordingly visited Orkney for the purpose of doing this, and having met with an intelligent workman, Alexander Ballantyne, in Kirkwall, took him with me on August 23 to Swanbister.

We found there the anemometer well placed on a low hill-top, distant about half a mile from the sea-beach, but freely exposed on all sides, with the exception of some higher hills a few miles distant to the north and west. It stands on the roof of a hut brought with it from Sandwick, but raised about 3 feet higher above the ground, the hut being built on a stone foundation of that height.

I completely dismounted the instrument, and cleaned it throughout and had the velocity shaft straightened, as well as fitted new bearings, which I took with me, to the vane shaft. I also checked the orientation points, and the south mark of the sunshine recorder.

The observer, Mr. Fortescue, exhibits much interest in the anemometer, and rendered me great assistance.

North Shields, August 11 and August 31—September 3.—I visited this town on August 11th, and was met at the railway station by Mr. Irvine, the observer at that town, and Mr. Spence, one of the Tyne Improvement Commissioners. In the company of these gentlemen I visited the high lighthouse, where we met Mr. Cairn, the assistant engineer of the Commission, with whom we discussed the placing of the anemometer on the lighthouse roof, and the necessary alterations required to the building in order to accommodate it.

I re-visited the lighthouse on August 31, when Mr. Massent, the Tyne engineer, attended with his workmen, and gave orders to proceed with the erection of the anemograph. The instrument was accordingly unpacked, hoisted to its place, put in rough adjustment, and started on September 2nd. The next day its fitting up was completed, Captain Harrison, the light-keeper, and his assistant, instructed in its management, the orientation properly determined, and the instrument left in action.

The anemograph is fixed on the chimney stack, surmounting the roof of the lighthouse, two chimney pots having been removed to afford the necessary space to accommodate the anemometer column, whilst the shafts are suspended in two disused flues, the recorder being placed over the disused fireplace in the light-room. The lighthouse stands on the north edge of the bank of the Tyne, at a height of approximately 90 feet above high water, the tower being about 60 feet high. The anemometer cups stand at an estimated height of 150 feet above the river. The exposure is perfectly free on all sides.

Fleetwood, visited August 12.—In company with Mr. Gaulter, the town surveyor, I inspected the intended site for the anemometer. I found it to be on the roof of an ornamental pavilion in the public gardens, occupying the top of a low sand hill on the sea-shore.

On my return to Fleetwood on September 6 the ornamental finial was removed from the roof, and the conical top cut down until a base sufficiently large to support the anemometer column was obtained; holes were bored down through the roofing timbers and ceiling to permit of the passage of the shafts.

The anemograph was erected in the centre of the pavilion, precautions being taken to prevent children and the numerous visitors tampering with the instrument, for as the building is used as a public refreshment room, it is frequently crowded during fine summer weather. The true south was determined by a solar observation, and a mark made on the roof for orientation of the instrument. Instructions as to changing of papers, necessary oiling, etc., were given to Messrs. Gaulter and Yeo, and the anemograph being completely adjusted, was started on September 8th.

October 1886. G. M. WHIPPLE.

DEAR SIR, Kew Observatory, November 9th, 1886.

I BEG leave to hand you herewith my report to the Meteorological Council respecting their self-recording instruments at the Falmouth and Valencia Observatories.

Falmouth.—The instruments were inspected on the following dates.

On October 11th the barograph and thermograph were examined, the clocks taken to pieces and cleaned, as well as the lenses and condensers. A good deal of stray light was observed to fall on the thermograph cylinder, thus discolouring the photographic paper; this was rectified by the re-blackening of both the dry and wet tubes. After cleaning, the action of the barograph light-stop was somewhat uncertain, but this was corrected by adding a small weight to the lever of the shutter.

The photography was excellent. The standard thermometers for the control observations were compared at 50° by means of a Kew standard and the following corrections determined :—

Dry 383 $-0°\cdot55$; Wet 388 $-0°\cdot35$.

The maximum and minimum thermometers were in good order.

On October 14th the rain-gauge was examined, when it was found that the oil of the friction rollers had become somewhat sticky and so retarded the free action of the float. After cleaning, however, the instrument worked satisfactorily.

The clock was cleaned and a new line attached.

The anemometer was inspected on the 18th and found to be in excellent order, the bearings of all parts being well oiled and in good condition. Mr. Kitto called my attention to the brass tubing of the direction shaft which had split. This I had soldered up again.

Valencia, October 25, 26, and 27.

At the time of my visit to this observatory Mr. Cullum was absent in England.

The whole of the instruments, however, were working satisfactorily, but the usual cleaning was performed of both clocks and instruments generally.

The zero values were changed from the summer to the winter position and the standard thermometers compared at 50° with my standard, the following corrections being found to be requisite :—

Dry bulb 399 $-0°\cdot55$; Wet 398 $-0°\cdot50$.
Max. 477 $-0°\cdot3$; Min. 2407 $-0°\cdot1$.

The new pen recently sent out for the self-recording aneroid was attached and adjusted on the 25th, and during my stay the instrument worked well.

On October 26th the electrical and recording parts of the mountain anemometer were erected by kind permission of the Anglo-American Telegraph Company in their workshop at the telegraph station.

Mr. Graves, the Superintendent, most kindly gave me every assistance, and placed a number of batteries at my disposal.

After the various connections had been joined up, both velocity and direction gear acted perfectly.

The working of the apparatus was explained to Mr. Windeler, the mechanician, who now thoroughly understands all the details.

Fuller's mercury-bichromate batteries are now entirely used by the Telegraph Company and are well adapted for the electrical anemometer, as their strength is nearly double that of either Daniell's or Leclanché cells; they also maintain their power for a greater length of time.

It was found by experiment that four of these cells were sufficient to work the direction apparatus on short circuit and 10 for the velocity, whilst 10 others were required for the relay, making 24 in all to work the instrument.

R. H. Scott, Esq., F.R.S. T. W. Baker.

APPENDIX VII.

Method of Dealing with Telegraphic Weather Intelligence.

The operations connected with the preparation and issue of the Forecasts and Storm Warnings have undergone some material changes, not only with regard to the home stations, but also in connection with the information received both from the European Continent, and from the United States. These arrangements are referred to more fully further on. The Daily Weather Report also has been improved by the introduction of the above-mentioned new reports, and by a re-arrangement of the Remarks and Forecasts given on page 3 of each Report.

The Office now receives, when the telegraphic communications are perfect, fifty-nine reports every morning, seventeen every afternoon (except on Sundays), and twenty-seven each evening.

The foreign reporting stations, 28 in number, extend along the entire western coast of the Continent, from Bodö in Lat. 67° N. to Lisbon in Lat. 38° N., and include four stations on the coast of the Baltic, three in Germany, and two in the Mediterranean. The information is received in accordance with arrangements made with the various Meteorological organisations in Portugal, France, Holland, Germany, Denmark, Norway, and Sweden.

At the British and Irish stations the morning observations are taken at 8 a.m. Greenwich time, and most of the telegrams arrive in London at about 9 o'clock, when the Intelligence Department of the Post Office extracts from them the portions required for its wind and weather reports. They are then transmitted to the Meteorological Office by its private wire, where the majority of them usually arrive between 9 a.m. and 10 a.m. No material interruptions have occurred in the communication with Sumburgh Head and Stornoway.

As the reports come in, the information is entered on a chart, showing for each station at 8 a.m. the barometrical and thermometrical readings, with their respective alterations during the preceding 24 hours, the direction and force of the wind, and the state of the

weather, together with any changes of importance which may have been noticed in the course of the preceding day. From this chart, which is preserved in the Office, other charts are drawn for publication in the newspapers, as described further on.

If necessary, telegraphic warnings of storms or of atmospherical disturbance are immediately sent to our own coasts and to foreign countries. A brief telegraphic resumé of the weather is despatched shortly after 11 a.m. to the Harbour Authorities and the Chamber of Commerce in Jersey. Another telegraphic message, of about 75 words, is sent to the Underwriters' Association, Liverpool, containing reports of the pressure, wind and weather at 14 stations on the coasts of the British Islands; and a third message of about the same length is forwarded to the Central News and to the Exchange Telegraph Company for despatch to the provinces. The last of these messages consists of a brief statement of the general condition of weather over Western Europe, as shown by the morning reports. It is, however, not in the morning only that storm warnings are issued to the coasts, a constant watch being kept during the day, and whenever on the receipt of the regular or of special telegrams the condition of the weather appears to be threatening, cautionary messages are at once issued to such parts of the coast as are thought to be menaced by a gale.

During the year 1886 there were prepared each morning, afternoon, and evening, Forecasts of the weather, for a day in advance; these were drawn up for eleven districts in the British Islands, and issued to subscribers, to certain Clubs, and to many of the London and Provincial newspapers in accordance with the arrangements referred to on p. 9. The districts for which the Forecasts were prepared are those into which the returns for the Weekly Weather Report are divided, viz.:—

0. Scotland, North.	4. Midland Counties.
1. „ East.	5. England, South.
2. England, N.E.	6. Scotland, West.
3. „ East.	7. England, N.W. (with N. Wales).

8. England, S.W. (with S. Wales).
9. Ireland, North.
10. „ South.

About an hour and a quarter is occupied in the preparation and transmission of the provincial and foreign telegrams, and in the drawing up of the "Remarks" and 11 a.m. Forecasts for the London newspapers, so that the MS. copies for the "Times" and other papers are ready for issue soon after 11 a.m.

Charts are prepared daily for newspaper publication as follows:—

For the "Times," - -	two daily, viz.:	for 8 a.m. and 6 p.m.
For the Patent Type Founding Company, on behalf of the "Shipping Gazette," and for distribution to the provincial press -	one „	for 8 a.m.

The 8 a.m. charts are sent out at about 10.15 a.m. and the 6 p.m. chart at about 8.30 p.m. In addition charts are drawn for 8 a.m. and 6 p.m. daily for exhibition at the Office door, together with some remarks, and the latest Forecasts issued.

In addition to the charts here referred to, the Patent Type-founding Company are supplied with various diagrams showing the changes in

pressure, temperature, rainfall, wind, and weather for the London district. These are engraved *daily* for the "Daily Chronicle," *weekly* for the "Graphic," and *monthly* for the "Miller," and are all accompanied by remarks on the phenomena exhibited.

The draft of the Daily Weather Report, with two charts attached, is drawn on transfer paper, and is ready by noon, when it is at once sent to the lithographer to be printed. The copies for delivery by hand and by early post in London are issued at about 1.30 p.m., while the remainder are received at the Meteorological Office at about 3.30 p.m. whence they are transmitted by post to the subscribers and others.

At about 3 o'clock the 2 p.m. observations, taken at fifteen home stations, and two foreign ones (Skudesnaes and Rochefort) are received. Copies of these reports are issued, together with the 8 a.m. report, to certain newspapers and subscribers, and two copies of the "Remarks" (8 a.m. and 2 p.m.) are sent to the Type-founding Company for issue to provincial newspapers, in order to explain the 8 a.m. charts.

From 7 to 7.30 p.m. the twenty-seven evening (6 p.m.) reports arrive and are charted and discussed for the morning daily papers in accordance with the arrangement referred to on p. 10. The forecasts and remarks are usually ready by 8.30 p.m., but in bad weather, owing to the delay of the reports, and the additional care which is necessary in dealing with them, it is occasionally 9 p.m. before they are issued. The "Times" publishes in its First Edition the map showing the distribution of pressure, the winds, temperature, and weather at 6 p.m. on the previous day, and in its Second Edition a similar map for 8 a.m. on the day of issue.

The official charts for 2 p.m. and for 6 p.m. are still much less complete than that for 8 a.m., notwithstanding the great improvements recently made, especially in that for 6 p.m. That for 2 p.m. is drawn on the information received from fifteen home stations, supplemented by two foreign ones, whenever the latter arrive in time to be used. The material for the 6 p.m. charts is now supplied by reports from twenty stations in the United Kingdom, supplemented by seven* from continental stations, but the latter occasionally arrive late at the very time when they are most wanted, *i.e.*, during bad weather.

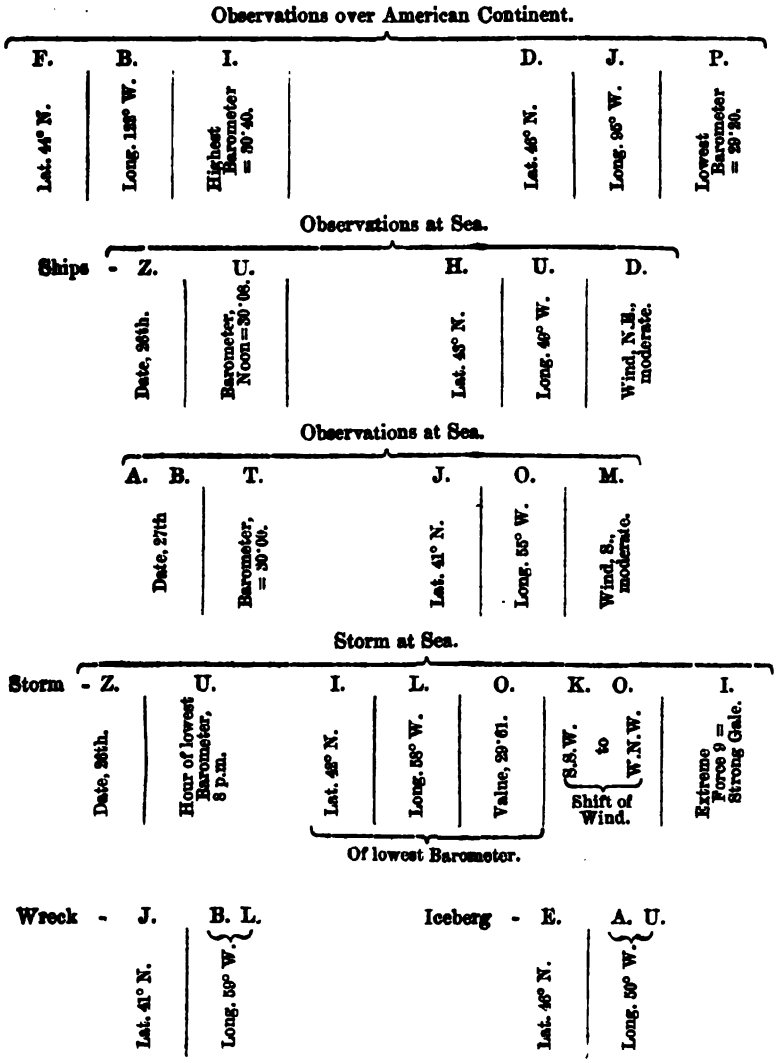
The Sunday duty is still conducted as follows:—Two of the clerks attend on Sunday mornings at the Central Telegraph Station from 8.30 a.m. to about 10.15 a.m. By an arrangement with the Post Office these clerks are supplied with the telegrams immediately they arrive in London. These are examined and charted, with the view of issuing, when necessary, warnings of coming storms, to our own and neighbouring coasts. It is necessary that great promptitude should be observed in this service, as the observations must be dealt with and the warnings issued so that the latter may reach the coast before the telegraph offices at the outports close for the day, which is usually at about 10 a.m. No work of any kind is transacted for the newspapers on Sunday mornings, the main object of the service being to give early information of storms to our coasts; but a telegram is sent to Jersey in the same form as on week days, and there is the ordinary interchange of messages with foreign countries. A copy of the Valencia message is sent to Lisbon. At 6 p.m. the same clerks attend at the Meteorological

* Steps are being taken to add another station to the 6 p.m. charts, but these are delayed by difficulties on the Continent.

Office to receive the evening reports and to prepare the 8.30 p.m. Forecasts, and another opportunity is thus afforded for the correction or extension of any warnings which may have been issued in the morning.

Atlantic Telegrams.

In the course of the year the arrangements for forwarding from the United States occasional reports of gales, icebergs, and derelict ships, which have been met with by passenger steamers of the principal lines running from various European ports to New York or Boston have been entirely re-modelled by the addition of information referring to the distribution of pressure over the American Continent, and the adjacent parts of the Atlantic. This is conveyed by means of a Code, drawn up in the following manner:—


Observations over American Continent.
F. Lat. 44° N.
B. Long. 128° W.
I. Highest Barometer = 30·40.
D. Lat. 46° N.
J. Long. 96° W.
P. Lowest Barometer = 29·20.
Observations at Sea.
Ships - Z. Date, 26th.
U. Barometer, Noon = 30·08.
H. Lat. 45° N.
U. Long. 46° W.
D. Wind, N.E., moderate.
Observations at Sea.
A. Date, 27th
B.
T. Barometer, = 30·06.
J. Lat. 41° N.
O. Long. 55° W.
M. Wind, S., moderate.
Storm at Sea.
Storm - Z. Date, 26th.
U. Hour of lowest Barometer, 8 p.m.
I. Lat. 42° N.
L. Long. 58° W.
O. Value, 29·61.
Of lowest Barometer.
K. S.S.W.
O. to W.N.W.
Shift of Wind.
I. Extreme Force 9 = Strong Gale.
Wreck - J. Lat. 41° N.
B. L. Long. 59° W.
Iceberg - E. Lat. 46° N.
A. U. Long. 50° W.

This arrangement* has been made through M. Mascart, the Director of the French Meteorological Bureau, to whom the messages are telegraphed direct from the United States. At present the messages are forwarded from Paris to this country by post, in order to curtail the cost of transmission until the Council are assured of the practical utility of the reports.

Daily Weather Report.

Some considerable change has been made during the past year both in the *form*, and in the matter published in the Daily Weather Report, by the addition of a daily statement as to the weather over Europe on the preceding day, by the insertion of reports from several new continental stations, and by a substitution for the remarks which used to appear on page 3 of each report, of notes descriptive of "the "general situation at 8 a.m.," and the "probable changes in system now prevalent." The information now fills four large quarto pages, and is arranged as follows:—

Page 1 contains the whole of the 59 reports from which the maps for the day (given on page 2) are prepared; also the 6 p.m. reports of the previous day, together with the maximum and minimum temperatures of the air, and the Rainfall for the previous 24 hours.

Page 2 contains (1) a map of North-western Europe showing for 8 a.m. on the date of publication, the distribution of pressure, the prevalent winds, and the sea disturbance, with necessary explanations; together with a table showing the mean atmospheric pressure for the month at 22 stations; (2) a similar map showing the distribution of temperature at 8 a.m., the weather at each station, and the distribution of rainfall during the past 24 hours; together with a table of the mean temperature of the air and of evaporation at 8 a.m., the means of the daily maximum and minimum temperatures, and the mean rainfall for the month at the same 22 stations in the United Kingdom.

Page 3 contains (1) notes on the "General situation at 8 a.m.," and the "Probable changes in system now prevalent;" and (2) the forecasts drawn up for each district at 11 a.m., relating to the weather likely to be experienced during the 24 hours ending at noon on the day succeeding that of publication.

Page 4 contains the reports for 2 p.m. on the previous day, and an account of the distribution of pressure, temperature, wind, and weather experienced over the European Continent on the previous day.

The standing portion of the report (maps, &c.) is printed in blue, while the information for each day is in black.

Weekly Summary.

On Monday in each week a brief Summary of the Weather experienced over our Islands during the preceding week is given on p. 4 of the Daily Weather Report. It refers only to the principal changes which have occurred, and is intended to serve as an aid to the study of the Daily Reports. The main meteorological features of the week are thus presented as a connected story, and afford greater facility for future reference.

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* Since the close of the financial year some further improvements have been made in the Code.

Correction and Addition List.

Additional steps are taken to insure accuracy in the Daily Weather Report. At the close of each month a return is received from nearly all of the telegraphic reporting stations, containing a copy of all the observations which have been transmitted to London by wire during the month. These schedules are used for checking the daily telegrams, for the preparation of the average and other values of the different elements, and also as evidence in the case of legal proceedings. About the middle of every month a lithographic sheet has for many years past been issued with the Daily Weather Report, containing corrections for all discrepancies which have been discovered, and supplying any observations which have been omitted in the published reports. This monthly sheet also contains tables showing the mean values for pressure, temperature, and humidity, together with the total rainfall, and the prevalence of various kinds of weather and of winds from each of the eight principal points during the month, for each telegraphic reporting station within our Islands.

WEEKLY WEATHER REPORT.

The Weekly Weather Report, which has appeared since the beginning of February 1878, has been further improved by the insertion on the first page, for each district, of the difference between the number of day-degrees of accumulated heat above and below 42° F., as well as of rainfall for each week, and the means for the corresponding period of the eight years 1878–85.

The tables of Accumulated Temperature are designed to give persons engaged in agriculture better means of estimating the manner in which vegetation is affected by temperature than that afforded by the more usual methods of treating the readings of the thermometer. They show for each week, and for the whole period from the beginning of the year, the weekly and progressive values respectively, of the combined amount and duration of the excess or defect of the air temperature, above or below a suitably fixed standard or *base temperature*. The base adopted is 42° F., as being nearly equivalent to 6° Cent. which has been considered by Continental writers on these subjects to be the critical value, the temperature above which is mainly effectual in starting and maintaining the growth, and in completing the ripening of agricultural crops in a European climate. This base is also convenient as being 10° F. above the Freezing Point.

The Report thus contains the average and extreme temperatures and the rainfall values and the total amount of bright sunshine in each week, for seventy stations grouped into twelve districts in Great Britain and Ireland, together with the difference between them and their respective mean values for the corresponding weeks in previous years. In addition to this, the district values for Accumulated Temperature, Rainfall, and Bright Sunshine are given, both for the week and for the whole period since the beginning of the year, with their difference from the average values.

The accumulated Temperature is expressed in Day-degrees; a Day degree signifying 1° F. of excess or defect of temperature above or below 42° F. and continued for 24 hours; or any other number of degrees for an inversely proportional number of hours.

It has been ascertained by calculation from a considerable series of hourly observations at various places, that the accumulated temperature

may be computed, with a very tolerable approximation to the truth, from the observed daily maximum and minimum temperatures alone.

When the temperature during any period remains either wholly above or below the base temperature, the difference between the base and the mean temperature gives the correct accumulated value. In other cases this difference gives an approximate value of the accumulated temperature which does not depart greatly from the truth, the deviation depending on the greater or less extent of the daily variations of the temperature above or below the base. Further, since the mean between the maximum and minimum of any day is nearly equal to the mean temperature of the day, the difference of the mean of the maximum and minimum from the base also will give directly a fair approximation to the accumulated temperature for the day.

The following rules, however, supply a still closer approximation to the true values sought, and they have been adopted for the preparation of the table in the Weekly Weather Report. They may be applied to any other base temperature as well as to 42° F., with the slight modification of the numerical coefficients.

RULES for computing for a WEEKLY PERIOD the ACCUMULATED TEMPERATURE above or below 42° F. from the observed MAXIMA and MINIMA.

1. Obtain the mean temperature from the means of the seven observed maxima and minima by multiplying the difference between them by the proper coefficient for the month, and adding the result to the mean of the minima.

2. In obtaining the accumulated temperature four cases may occur, to which the following rules will apply :—

Conditions of Temperature.	To obtain the Accumulated Temperature.	
	Above 42° F.	Below 42° F.
If the minimum is *above* 42° F. or *equal* to 42° F.	Subtract 42° F. from the mean.	There is none.
If the minimum is *below* 42° F., but the mean for the day is *above* 42° F.	From the difference between the mean for the day and the minimum deduct the accumulated temperature below 42° F., calculated as stated in the next column.	The required quantity is the excess of 42° F. over the minimum multiplied by the coefficient 0·4.
If the mean for the day is *below* 42° F., but the maximum is *above* 42° F.	The required quantity is the excess of the maximum over 42° F. multiplied by the coefficient 0·4.	From the difference between the mean for the day and the minimum deduct the accumulated temperature above 42° F., calculated as stated in the preceding column.
If the maximum is *below* 42° F., or *equal* to 42° F.	There is none.	Subtract the mean from 42° F.

In each case the result will be the mean *daily* value for the week, and must be multipled by 7 in order to obtain the value for the whole week.

The coefficient varies both with the length of the period and the value of the base line. In the above instance the base is 42°; when

Correction and Addition List.

Additional steps are taken to insure accuracy in the Daily Weather Report. At the close of each month a return is received from nearly all of the telegraphic reporting stations, containing a copy of all the observations which have been transmitted to London by wire during the month. These schedules are used for checking the daily telegrams, for the preparation of the average and other values of the different elements, and also as evidence in the case of legal proceedings. About the middle of every month a lithographic sheet has for many years past been issued with the Daily Weather Report, containing corrections for all discrepancies which have been discovered, and supplying any observations which have been omitted in the published reports. This monthly sheet also contains tables showing the mean values for pressure, temperature, and humidity, together with the total rainfall, and the prevalence of various kinds of weather and of winds from each of the eight principal points during the month, for each telegraphic reporting station within our Islands.

WEEKLY WEATHER REPORT.

The Weekly Weather Report, which has appeared since the beginning of February 1878, has been further improved by the insertion on the first page, for each district, of the difference between the number of day-degrees of accumulated heat above and below 42° F., as well as of rainfall for each week, and the means for the corresponding period of the eight years 1878–85.

The tables of Accumulated Temperature are designed to give persons engaged in agriculture better means of estimating the manner in which vegetation is affected by temperature than that afforded by the more usual methods of treating the readings of the thermometer. They show for each week, and for the whole period from the beginning of the year, the weekly and progressive values respectively, of the combined amount and duration of the excess or defect of the air temperature, above or below a suitably fixed standard or *base temperature*. The base adopted is 42° F., as being nearly equivalent to 6° Cent. which has been considered by Continental writers on these subjects to be the critical value, the temperature above which is mainly effectual in starting and maintaining the growth, and in completing the ripening of agricultural crops in a European climate. This base is also convenient as being 10° F. above the Freezing Point.

The Report thus contains the average and extreme temperatures and the rainfall values and the total amount of bright sunshine in each week, for seventy stations grouped into twelve districts in Great Britain and Ireland, together with the difference between them and their respective mean values for the corresponding weeks in previous years. In addition to this, the district values for Accumulated Temperature, Rainfall, and Bright Sunshine are given, both for the week and for the whole period since the beginning of the year, with their difference from the average values.

The accumulated Temperature is expressed in Day-degrees; a Day degree signifying 1° F. of excess or defect of temperature above or below 42° F. and continued for 24 hours; or any other number of degrees for an inversely proportional number of hours.

It has been ascertained by calculation from a considerable series of hourly observations at various places, that the accumulated temperature

may be computed, with a very tolerable approximation to the truth, from the observed daily maximum and minimum temperatures alone.

When the temperature during any period remains either wholly above or below the base temperature, the difference between the base and the mean temperature gives the correct accumulated value. In other cases this difference gives an approximate value of the accumulated temperature which does not depart greatly from the truth, the deviation depending on the greater or less extent of the daily variations of the temperature above or below the base. Further, since the mean between the maximum and minimum of any day is nearly equal to the mean temperature of the day, the difference of the mean of the maximum and minimum from the base also will give directly a fair approximation to the accumulated temperature for the day.

The following rules, however, supply a still closer approximation to the true values sought, and they have been adopted for the preparation of the table in the Weekly Weather Report. They may be applied to any other base temperature as well as to 42° F., with the slight modification of the numerical coefficients.

RULES for computing for a WEEKLY PERIOD the ACCUMULATED TEMPERATURE above or below 42° F. from the observed MAXIMA and MINIMA.

1. Obtain the mean temperature from the means of the seven observed maxima and minima by multiplying the difference between them by the proper coefficient for the month, and adding the result to the mean of the minima.

2. In obtaining the accumulated temperature four cases may occur, to which the following rules will apply :—

Conditions of Temperature.	To obtain the Accumulated Temperature.	
	Above 42° F.	Below 42° F.
If the minimum is *above* 42° F. or *equal* to 42° F.	Subtract 42° F. from the mean.	There is none.
If the minimum is *below* 42° F., but the mean for the day is *above* 42° F.	From the difference between the mean for the day and the minimum deduct the accumulated temperature below 42° F., calculated as stated in the next column.	The required quantity is the excess of 42° F. over the minimum multiplied by the coefficient 0·4.
If the mean for the day is *below* 42° F., but the maximum is *above* 42° F.	The required quantity is the excess of the maximum over 42° F. multiplied by the coefficient 0·4.	From the difference between the mean for the day and the minimum deduct the accumulated temperature above 42° F., calculated as stated in the preceding column.
If the maximum is *below* 42° F., or *equal* to 42° F.	There is none.	Subtract the mean from 42° F.

In each case the result will be the mean *daily* value for the week, and must be multipled by 7 in order to obtain the value for the whole week.

The coefficient varies both with the length of the period and the value of the base line. In the above instance the base is 42°; when

it is 32° the coefficient is 0·4; when 52° it is 0·33; and when 62° it is 0·25.

A full explanation of these rules will be found in Appendix II. to the Quarterly Weather Report for 1878.

The temperature means derived from the daily maxima and minima are corrected so as to agree as closely as possible with the true mean daily value, and, the average values for the corresponding period in former years having been recomputed, those now in use are:—

For Temperature	- -	20 years 1861–80
„ Rainfall	- -	20 „ 1866–85

These statistics are given on the first page of the publication, the temperature, accumulated heat, rainfall, and sunshine values for *each station** being given on the last page of each report.

In addition to the telegraphic reports, and the returns from the self-recording observatories, weekly returns from 43 volunteer observers are used in preparing this report, the names of the observers at each station being as under—

Names of Stations.	Names of Authorities.
Alnwick Castle - - -	Lieut.-Col. F. Holland, for the Duke of Northumberland, K.G.
Arlington (N. Devon) - -	J. Carter, for Lady Chichester.
Bawtry (Hesley Hall) - -	B. I. Whitaker, F.R. Met. Soc.
Blackpool - - -	Rev. C. T. Ward, F.R. Met. Soc.
Braemar - - -	J. A. Aitken.
Brookeborough - - -	Mr. Ferguson, for Sir Victor Brooke, Bt., F.L.S.
Cheadle - - -	J. C. Philips.
Churchstoke - -	P. Wright, F.C.S., F.R. Met. Soc.
Cirencester - - -	The Royal Agricultural College.
Cullompton - - -	T. Turner, J.P., F.R. Met. Soc.
Douglas (Isle of Man) - -	A. W. Moore, M.A., J.P.
Dublin - - - -	J. W. Moore, M.D., F.R. Met. Soc.
Durham Observatory - -	H. J. Carpenter.
Edgeworthstown (Currygrane) -	J. M. Wilson, J.P.
Fort Augustus - -	Rev. W. M. Wall.
Foynes - - - -	T. J. Carey, for Lord Monteagle, K.P.
Geldeston - - - -	E. T. Dowson, F.R. Met. Soc.
Glen Carron - -	D. D. Munro.
Glenlee - - -	G. Maxwell and W. Melville.
Hastings (St. Leonard's) - -	H. Colborne, M.R.C.S.
Hereford - - -	T. A. Chapman, M.D.
Hillington - - -	Rev. H. E. B. Ffolkes, M.A., F.R. Met. Soc.
Ingatestone - - - -	L. J. Petre, F.R. Met. Soc.
Kilkenny - - - -	H. Carlton, for the Marquis of Ormonde.
Killarney - - - -	The Ven. Archdeacon Wynne, F.R. Met. Soc.
Lairg - - -	W. Ross, Ground Officer.
Laudale (Loch Sunart) - -	A. Fletcher, for T. H. G. Newton, F.R. Met. Soc.
Leicester - - - -	J. C. Smith, the Museum.
Llandovery - - - -	J. Watkins, F.R. Met. Soc.
Llandudno - - -	J. Nicol, M.D., F.R. Met. Soc
Londonderry - - -	J. Conroy, F.R. Met. Soc.

* The sunshine values are furnished for only a limited number of carefully selected stations. See p. 96.

Names of Stations.	Names of Authorities.
Manchester (Prestwich) - -	T. R. H. Clunn, M.D., F.R. Met. Soc.
Marchmont - - - ℌ	P. Lowry.
Markree Castle (Sligo) - -	A. Marth, F.R.A.S., for Colonel Cooper, F.R.A.S.
Newton Reigny (Penrith) - -	T. G. Benn, F.R. Met. Soc.
Ochtertyre - - - ℌ	G. Croucher.
Plymouth - - - -	J. Merrifield, LL.D., F.R.A.S.
Rothamsted - - -	Rainfall by Sir J. B. Lawes, Bart., LL.D., F.R.S., and J. H. Gilbert, Ph.D., F.R.S.; temperature by T. Wilson, F.R. Met. Soc.
Scarborough - - - ℳ	A. Rowntree, F.R. Met. Soc.
Southampton - - -	J. T. Cook, R.E., Ordnance Survey Office.
Stowell - - - ℳ	Rev. H. J. Poole, F.R. Met. Soc.
Strathfield Turgiss - - ℳ	Rev. C. H. Griffith.
Waterford (Brook Lodge) - -	C. Percival Bolton.

The returns marked "ℳ" are supplied through the Royal Meteorological Society, those marked "ℌ" are through the Scottish Meteorological Society.
* N.B.—Seven new Scotch stations have been added since January 1st, 1887.

The report is prepared on Wednesday in every week, and is ready for sale early on Saturday morning, but the summary on its first page is sent to the "Times," "Daily News," and some other papers on Wednesday evening.

A *Quarterly Summary* of the Weekly Weather Report has been also issued as Appendix I., giving for each of the 12 districts before referred to (1) the Mean Temperature for each Quarter and for the Whole Year, in each year from 1878 to 1886 inclusive, and the means for certain groups of years; (2) the Total Rainfall for the same periods; and (3) the Accumulated Temperature, Rainfall, and Bright Sunshine for each month in the Quarter.

Appendix II. gives for each district and for the years 1885 and 1886 the weekly and progressive values for (1) Accumulated Heat (above and below 42°); (2) Rainfall (number of rainy days, and amounts in inches); and (3) Bright Sunshine (number of hours and percentage of possible duration).

Appendix III. gives the *Mean Weekly* values for the same phenomena, in the following periods, viz.:—

Accumulated Heat, and Rainfall, 8 years, 1878 to 1885.
Bright Sunshine - - 5 years, 1881 to 1885.

Monthly Weather Report.

During 1886 the issue of the *Monthly Weather Report* has been continued. It contains, as hitherto, (1) A General Summary for the Month, of the weather experienced over the United Kingdom and its neighbourhood; (2) Tables of the principal Cyclonic and Anticyclonic Systems which have passed over our area during the month; and (3) Tables of Pressure, Temperature, Hygrometric Deductions, Rainfall, Weather, Wind, and Bright Sunshine experienced at a large number of stations scattered over the United Kingdom, together with remarks thereon; it is illustrated by two plates. The report is, therefore, as far as possible, similar to the Quarterly Weather Report, but owing to its prompt issue, cannot contain either the Gale Tables, or the Tables of Mean Values for the Observatories, which are found in its predecessor.

Issue of Forecasts.

Remarks on the actual state of the weather, and forecasts *for not more than one day in advance*, are prepared at the Meteorological Office as under:—

On Week Days.

(1.) At 11 a.m. (from the morning reports), for the 24 hours ending at Noon on the day following the date of issue. This issue is intended especially for the early editions of the evening papers, for the clubs, and for exhibition at certain selected stations. See p. 9.

(2.) At 3.30 p.m. (from the morning and afternoon reports), for the day following that of issue. This set of Forecasts is not intended for publication in newspapers, but a copy is exhibited regularly at the door of the Meteorological Office.

(3.) At 8.30 p.m. (from the 6 p.m. reports), for the day following that of issue. These are now supplied gratis to any newspaper or news agency which may apply for them, and send for them regularly. A very large number of the most important papers avail themselves of this advantage.

The forecasts are made for the following districts:—

0. Scotland, North.
1. Scotland, East.
2. England, N.E.
3. England, East.
4. Midland Counties.
5. England, South.
6. Scotland, West (with Isle of Man).
7. England, N.W. (with North Wales).
8. England, S.W. (with South Wales).
9. Ireland, North.
10. Ireland, South.

The remarks and forecasts are posted at the doors of the Meteorological Office, 116, Victoria Street, S.W., on week days, for the inspection of the public. Copies, or extracts from them, are communicated under the conditions stated below, but no information which is not substantially included in them can be supplied.

Forecasts for Private Subscribers.—Any person can be supplied with a copy of the 11 a.m. Forecasts, once on each week day,* on payment of a subscription of ten shillings per annum, or 2*s.* 6*d.* per official quarter *or any part thereof, in addition to the cost of transmission*; the charges will therefore be, by *letter* post, 9*s.*, by *book* post, 5*s.* 9*d.* per quarter.

The forecasts for any of the districts and for any of the hours mentioned above can be forwarded by telegraph daily, on payment of 3*d.* per day for any definite period of not less than one week, in addition to the cost of telegraphy.

Forecasts for Clubs.—Forecasts, drawn up at 11 a.m., for all the districts, are supplied to Clubs, for a subscription of ten shillings per

* Good Friday and Christmas Day are reckoned as Sundays.

annum. These are delivered free, by hand, to Clubs situated in or near Pall Mall. Special arrangements can be made for delivery at a greater distance by hand or by post.

FORECASTS FOR HAY AND CORN HARVESTS, OR FOR PUBLIC USE.—Special facilities are offered for the transmission of Forecasts for these purposes, a nominal fee of 2*s.* 6*d.* being charged for a quarter or any part thereof, in addition to the cost of the telegrams.

EXHIBITION OF TELEGRAPHIC FORECASTS AT LOCAL POST OFFICES.—The Post Office has sanctioned the exhibition of Forecasts at Local Post Offices, provided space is available, if the persons to whom they are addressed desire them to be so exhibited instead of being delivered.

DAILY WEATHER REPORTS.—The lithographed Reports will have the 11h. a.m. Forecasts incorporated with them on each week day. The subscription for the Report is—

For delivery by hand, where feasible, £2 *per annum;*
Do. by book post £1 „

MS. copies of the observations can be supplied at the rate of 2*l.* 10*s.* per annum. Arrangements can also be made for the supply of charts drawn from the 8h. a.m. or 6h. p.m. observations, such as appear in the "Times."

Unless otherwise arranged, all forecasts transmitted by post are sent by book post, not as letters.

INQUIRIES as to the WEATHER.

INQUIRIES PERSONALLY OR BY MESSENGER.—Any person applying at the Meteorological Office between 11 a.m. and 8 p.m. on week days, and between 7 p.m. and 8 p.m. on Sundays, can be supplied in writing with the latest information in the possession of the Office and with the latest forecast issued for any specified district, on payment of one shilling for each inquiry.

INQUIRIES BY LETTER.—Application may be made by letter, enclosing thirteen pence in stamps if the reply is to be *by post*, and one shilling in stamps in addition to the cost of the reply, consisting of ten words, exclusive of the address, if the reply is to be *by telegraph*.

INQUIRIES BY TELEGRAPH.—Any person may obtain *by telegraph* from the Meteorological Office the latest information as to the weather in any district of the United Kingdom by payment of a fee of 1*s.* in addition to the cost of a telegram and reply to any post office. The telegram containing the inquiry must be addressed as follows:

WEATHER,
LONDON.

The payment for the reply should be for ten words in addition to the address.

Application may also be made for similar information to be sent either *by telegraph* or *post* on some future specified day.

CHECKING of FORECASTS.

In order to test the accuracy of the forecasts they have been compared carefully with the weather reported in the various districts on the days to which they referred, and the results of this checking for 8.30 p.m. have been already given in the Report (p. 10).

In carrying out this comparison the portions of the forecasts which referred to wind have been carefully separated from those relating to weather. The detailed results of the comparison will be found in Appendix XI., p. 82.

Checking of Storm Warnings.

The testing of the warnings is conducted in the following manner. The intelligence issued is compared with the weather experienced on the coasts, as indicated by the various self-recording anemometers, by the telegraphic reporters, and by several gentlemen who have volunteered to observe for the Office, and whose names will be found in Appendix XIV., p. 92.

In order to render the information in the possession of the Office as to the weather experienced on our coasts still more complete, the Council have, as in preceding years, made application to the various Lighthouse Boards, and have obtained from them the original log-books from some of the most exposed lightships and lighthouses. They would here express their cordial thanks for the co-operation so readily granted to them by these Boards.

The result of the checking for 1886 will be found on p. 13.

The coasts are subdivided into ten districts, as will be seen in the table. Two large tracts of coast are entirely omitted: viz., the west of Ireland from the Shannon to Malin Head, and the West of Scotland from the Mull of Cantyre to Cape Wrath. No warnings are issued to any place within the limits indicated, except to Galway, and the amount of information as to the weather received from the omitted portion of the Scotch coast is, as yet, very scanty.

It should be remembered that in analysing the reports, all observations of the wind in which the force *exceeded* 7 (a "moderate gale") or the velocity exceeded 40 miles an hour, have been quoted as instances of the occurrence of a gale; but it has not been considered that the signal was hoisted late or was hauled down too soon, unless the force of 9 (a "strong gale") or the velocity of 50 miles an hour, was reached prior to the issue of the order to hoist, or subsequent to the issue of the order to lower.

In the Summaries all cases in which the signal has been shown to be late by a single report either of force 9, or of a velocity of 50 miles an hour, have been specially noted.

APPENDIX VIII.

List of Persons, Places, &c. to which the Lithographed Daily Weather Report is supplied, free of cost.

Newspapers:

Lloyd's Shipping List.
New York Herald.
Times (1st and 2nd editions).

For Exhibition at Seaports:

Banff.
Barrow-in-Furness.
Belfast.
Blackpool.
Bo'ness.
Boscastle.
Brighton.
Briton Ferry.
Broughty Ferry.
Buckie.
Budehaven.
Caernarvon (2).
Cork.
Cowes.
Cromer.
Cullercoats.
Deptford Yard.
Dover.
Dundee.
Exeter.

For Exhibition at Seaports—cont.

Falmouth.
Glasson Dock, Lancaster.
Great Grimsby (2 copies).
Groomsport.
Hastings.
Hayle.
Holyhead.
Kingstown (2 copies).
Lancaster.
Leith.
Margate.
Morecambe (2).
Nairn.
Newquay.
Penarth.
Plymouth.
Plymouth G. W. Docks.
Port Dinorwic.
Porthcawl.
Queenstown.
St. Leonards.
St. Sennen Cove.
Scarboro'.
Southport.
Teignmouth.
Ventnor (2 copies).
Weston-super-Mare.
Wisbech.

In exchange for Observations:

Aird, G. H., Seaham.
Bellingham, J. G., Saffron Walden.
Ben Nevis Observatory.
Benn, T. G., F.R. Met. Soc., Newton Reigny.
Chatham, The Instructor in Surveying: 2 copies.
Clark, J. E., B.A., B.Sc., York.
Colborne, H., M.R.C.S., St. Leonards.
Conroy, J., F.R. Met. Soc., Londonderry.
Cooper, Col., F.R.A.S., Markree, near Sligo.
Dowson, E. T., F.R. Met. Soc., Geldeston, Beccles.
Durham, University Observatory.
Eastern Telegraph Co.
Fleetwood, L. & N.W. Ry. Co.
Greenwich Observatory.
Leicester Museum.
Mellish, H., F.R. Met. Soc., Worksop.
Moore, A. W., Isle of Man.
Moore, F. W., Glasnevin, Dublin.
Moore, J. W., M.D., F.R. Met. Soc., Dublin.
Mullins, Rev. G. H., F.R. Met. Soc., Uppingham.
Northumberland, Duke of, Alnwick.
Ordnance Survey Office (Southampton).
Prestwich Asylum, near Manchester.
Propert, W. P., LL.D., F.R. Met. Soc., St. David's.
Radcliffe Observatory, Oxford: 2 copies.
Richards, W. H., Penzance.
Rosse, Earl of, F.R.S., Parsonstown.
Royal Indian C.E. College, Cooper's Hill.
Rugby Natural History Society.
Sheffield Public Museum.
Southport, Fernley Observatory.
Stow, Rev. F. W., M.A., F.R. Met. Soc. Aysgarth, Bedale.
Telegraphic Reporters: 25.
Yorkshire Philosophical Society.

Government Offices, &c.:

Admiralty: 11 copies.
Aldershot, Garrison Library.
Army Medical Department.
" " Woolwich.
Board of Trade: 3 copies.
"Britannia," H.M.S., Dartmouth.
Channel Squadron, Admiral Commanding.
Commons, House of.
Devonport Captain of Steam Reserve.
" Commander-in-Chief.
" Dockyard: 2 copies.
" Master Attendant.
Dublin, General Register Office.
Farnborough Station, Staff College.
Greenwich, R.N. College.
"Indus," H.M.S., Devonport.
Ireland, Royal College of Science.
Lords, House of.
Mann, J. R., Osborne.
Medical Department of the Navy.
"Nankin," H.M.S., Milford Haven
Portland, Senior Naval Officer.
Portsmouth, Commander-in-Chief.
" Dockyard.
" R. N. College Observatory.
Queenstown, Rear-Admiral.
Registrar General.
" " of Seamen.
Science and Art Department: 2 copies.
Sheerness, Commander-in-Chief.
" Dockyard.
War Office, Adjutant General, Horse Guards.
Commander-in-Chief.
Woolwich Royal Military Academy.

Societies, &c.:

Agents: 2 copies.
Association of Underwriters, Liverpool.
" " Lloyd's.
British Museum.
Buchan, A., F.R.S.E., Edinburgh.
Crossley, Mrs., Halifax.
De La Rue & Co., Messrs.
Farrer, Sir T. H., Bt.
Griffith, Rev. C. H., Strathfield Turgiss.
Jackson, H. Kains, London.
Ley, Rev. W. C., M.A., Lutterworth.
Meteorological Council: 2 copies.
Miller, S. H., F.R.A.S., Lowestoft.
Observatories: 7 copies.
Richards, Adm. Sir G. H., K.C.B., F.R.S., London.
Royal Society: 2 copies.
" Meteorological Society.
Scottish Meteorological Society.

Foreign Places—cont.

Algiers, Meteorological Service.
Amsterdam Meteorological Institute.
Bombay, Observatory.
Brussels, Royal Observatory.
Cairo, Observatoire Khédivial.
Calcutta, Meteorological Department.
Chemnitz, Meteorological Service of Saxony.
Christiania, Meteorological Institute.
Constantinople, Imperial Meteorological Observatory.
Copenhagen, Meteorological Institute.
Cracow, Observatory.
Florence, Museum.
Freeden, W. H. von, Bonn.
Hamburg, Deutsche Seewarte.
Lisbon, Observatory.
Madrid, Royal Observatory.
Melbourne, Observatory.
Munich Meteorological Office.
Paris, Central Meteorological Bureau.
„ Meteorological Society.
„ Ministry of Marine.
Rome, Meteorological Institute.
San Fernando, Observatory.
St. Petersburg, Central Physical Observatory.
Stockholm, Meteorological Institute.
Tiflis, Physical Observatory.
Tokio, Imperial Observatory.
Toronto, Meteorological Office.
Upsala, University Observatory.
Utrecht, Royal Meteorological Institute.
Vienna, Imperial Meteorological Institute.
Washington, Smithsonian Institution.
„ United States Naval Observatory.
„ Chief Signal Officer, War Office.
Zürich, Central Meteorological Institute.

APPENDIX IX.

Fishery Barometers.

List of Places supplied with Fishery Barometers.

Shetland Isles.—Balta Sound, Uya Sound, Lerwick, Sandsair, Symbister, Scalloway.

Orkney Isles.—Burray. Kirkwall.

Scotland, east coast.— Stroma, Keiss, Staxigoe, Wick, Sarclet, Lybster, Dunbeath, Portmahomack, Cromarty, Avoch, Nairn, Burghead, Portessie, Port Knockie, Portsoy, Whitehills, Gardenstown, Rosehearty, Pitullie, Inverallochy, Pointlaw, Findon, Portlethen, Muchals, Skateraw, Stonehaven, Arbroath, Broughty Ferry, St. Andrews, Crail, Cellardyke, St. Monance, Burntisland, Newhaven.

England, east coast.—Berwick, Beadnell, North Shields, South Shields, West Sunderland, Hartlepool, Staithes, Scarborough, Filey, Flamborough, Bridlington Quay, Withernsea, Hull, Lynn (2), Wells, Gorleston, Harwich, Brightlingsea, Wivenhoe, Margate, Deal (2), Kingsdown, Dover.

England, south coast.—Bognor, Portsea, Ryde and Ventnor (2) (Isle of Wight), Gorey (Jersey), Haslar Hospital, Poole, Weymouth, Portland, Budleigh-Salterton, Cawsand, Charlestown, Mevagissey, Gorranhaven, Devoran, Portscath, Penryn, Durgan, Porthallow, Falmouth, Coverack, Newlyn, Mousehole.

England, south-west coast.—St. Ives, Hayle, Padstow, Port Isaac, Boscastle, Fremington, Burnham, Highbridge, Weston-super-Mare.

Wales.—Briton Ferry, Swansea, Angle, Milford, Abersoch.

England, north-west coast.—Fleetwood, Morecambe, Maryport.

Isle of Man.—Douglas, Port St. Mary, Peel.

Scotland, south-west coast.—Port Patrick, Stranraer.

Ireland, east coast. — Cushendall, Belfast, Bangor, Groomsport, Donaghadee, Strangford, Ardglass, Carlingford, Greenore, Dundalk, Malahide, Howth, Kingstown (2), Bray.

Ireland, south coast.—Dunmore, Dungarvan, Crosshaven, Kinsale, Union Hall, Castletownsend, Baltimore, Schull, Crookhaven.

Ireland, west coast.—Valencia, Dingle, Tralee, Tarbert, Kilcredane, Barna, Elly Bay, Ballyglass, Ballycastle (Co. Mayo), Donegal, Tribane, Killybegs, Teelin, Portnoo, Burton Port, Bunbeg.

Ireland, north coast.—Dunfanaghy, Rathmullen, Buncrana, Greencastle, Portrush, Portstewart.

Scotland, west coast.—Tarbert, Campbeltown, Carradale, Portree (Isle of Skye), Plockton.

Hebrides.—Stornoway, Cromore, Babyle, Obb, Ness.

SUMMARY of STATIONS supplied with INSTRUMENTS.

England and Wales	69
Scotland	54
Ireland	46
	169

APPENDIX X.

TELEGRAPHIC WEATHER INTELLIGENCE.

The following stations are supplied with telegraphic information of storms, free of expense, and signal "cones" have been furnished to most of them, all further expenses attendant on the maintenance and repair of the apparatus being borne locally. The stations are situated,

83 in England and Wales, 39 in Scotland, 15 in Ireland, 3 in the Isle of Man, and 3 in the Channel Islands.

NORTH.	WEST.	SOUTH.	EAST.
SCOTLAND. EAST COAST.	ENGLAND, N.W.	ENGLAND, S.W.	ENGLAND, E.
Dunrossness.	Ramsey.	Ilfracombe.	Eyemouth.
Lerwick.	Douglas.	Appledore.	Berwick-on-Tweed.
Scalloway.	Castletown.	Boscastle.	Tynemouth.
Kirkwall.	Silloth.	Port Isaac.	S. Shields.
Holborn Head.	Maryport.	Newquay.	Sunderland.
Wick.	Workington.	Hayle.	Middlesborough.
Inverness.	Whitehaven.	Scilly.	Redcar.
Nairn.	Barrow.	St. Sennen.	Whitby.
Burghead.	Morecambe.	St. Just.	Filey.
Lossiemouth.	Fleetwood.	Penzance.	Bridlington Quay.
Buckie.	Blackpool.	Falmouth.	Hull.
Portsoy.	Lytham.	Pendennis.	Goole.
Banff.	Southport.	Mevagissey.	Grimsby.
Cullen.	Runcorn.	Plymouth.	Boston.
Fraserburgh.	Liverpool.	Teignmouth.	Sutton Bridge.
Peterhead.	ENGLAND, W.	Exmouth.	Lynn.
Aberdeen.	Connah's Quay.		Sheringham.
Stonehaven.	Port Penrhyn.		Cromer.
Montrose.	Holyhead.		
Broughty Ferry.	Port Dinorwic.		
St. Andrews.	Carnarvon.		
Dundee.	Aberystwith.	ENGLAND, S.	ENGLAND, S.E.
Bo'ness.	Milford.	Guernsey.	Yarmouth.
Grangemouth.	Pembrey.	St. Helier's (Jersey).	Southwold.
Anstruther.	Swansea.	Gorey (Jersey).	Ipswich.
Pittenweem.	Llanelly.	Weymouth.	Harwich.
Burntisland.	Briton Ferry.	Poole.	Chatham.
Granton.	Porthcawl.	Cowes.	Sheerness.
Newhaven.	Penarth.	Ryde.	Faversham.
Leith.	Cardiff.	Portsmouth.	
Fisherrow.	Newport.	Littlehampton.	
Dunbar.	Weston-super-Mare.	Brighton.	
Cockburnspath.	Burnham.	Newhaven.	
		Hastings.	
	IRELAND, E.	Rye.	
	Belfast.	Sandgate.	
	Donaghadee.	Dover.	
	Howth.	Margate.	
FIRTH OF CLYDE.	Kingstown.		
Glasgow.	IRELAND, S. and W.		
Greenock.	New Ross.		
Rothesay.	Dunmore East.		
Campbelton.	Dungarvan.		
Girvan.	Youghal.		
Ballantrae.	Queenstown.		
	Passage.		
	Kinsale.		
	Cork.		
	Tralee.		
	Limerick.		
	Galway.		

The signals used consist of:—

1. Cone, point downwards for Southerly gales; S.E. round by S. to N.W.
2. Cone, point upwards for Northerly gales; N.W. round by N. to S.E.

The signals are to be kept hoisted *during the daylight only*, until 48 hours have elapsed from the time *the telegram was despatched*, unless countermanded. At night, lanterns may be used wherever the local authorities deem it desirable to do so.

The meaning of the signals is that an atmospherical disturbance exists (which will be explained in the telegram), and will probably, but not *necessarily*, cause a gale at the place warned, *from the direction* indicated by the signal.

The Meteorological Office supplies the canvas shapes and lanterns to such places as require them, on loan, but in all cases the local authorities must undertake the charges incidental to the hoisting of the signal, such as flagstaff and gear, oil, &c., and also to the keeping of the apparatus in repair, painting, &c.

APPENDIX XI.

REPORT ON THE COMPARISON OF THE FORECASTS ISSUED AT 8.30 p.m. WITH THE WEATHER SUBSEQUENTLY EXPERIENCED, for the 12 Months, April 1886 to March 1887.

The letters used have the following signification:—

a = complete success.	c = partial failure.
b = partial (more than half) success.	d = total failure.

The checking has been conducted on the same system as that employed in previous years, *i. e.*, each forecast has been considered under the separate headings of "Wind" and "Weather," but the results of the 8 p.m. Forecasts only are here published.

The first column gives the percentage of success in "Wind," the second in "Weather," and the third the average of the two.

The Summary for the whole year is given at page 10.

Districts.		April 1886. Percentages. Wind.	Weather.	Average.	a + b.	May 1886. Percentages. Wind.	Weather.	Average.	a + b.	June 1886. Percentages. Wind.	Weather.	Average.	a + b.
Scotland, N.	a	57	53	55		37	60	49		63	40	52	
"	b	27	37	32	87	43	30	36	85	27	33	30	82
"	c	10	7	9		17	0	9		7	17	12	
"	d	6	3	4		3	10	6		3	10	6	
Scotland, E.	a	54	47	51		47	50	49		64	64	64	
"	b	33	27	30	81	37	27	32	81	33	13	23	87
"	c	10	26	18		13	7	10		0	10	5	
"	d	3	0	1		3	16	9		3	13	8	
England, N.E.	a	60	47	54		57	43	50		70	50	60	
"	b	23	20	21	75	36	24	30	80	27	27	27	87
"	c	10	20	15		7	13	10		3	7	5	
"	d	7	13	10		0	20	10		0	16	8	
England, E.	a	63	40	52		61	37	49		64	37	51	
"	b	27	43	35	87	32	30	31	80	30	37	33	84
"	c	7	10	8		7	13	10		3	13	8	
"	d	3	7	5		0	20	10		3	13	8	
Midland Cos.	a	60	40	50		68	43	56		77	47	62	
"	b	24	40	32	82	32	30	31	87	20	37	29	91
"	c	13	13	13		0	10	5		0	6	3	
"	d	3	7	5		0	17	8		3	10	6	
England, S.	a	57	50	54		59	31	45		60	47	54	
"	b	27	37	32	86	31	38	35	80	37	23	30	84
"	c	13	10	11		7	14	10		0	13	6	
"	d	3	3	3		3	17	10		3	17	10	
Scotland, W.	a	47	60	54		31	33	32		54	43	49	
"	b	40	27	33	87	38	37	37	69	33	37	35	84
"	c	7	10	9		17	10	14		10	3	6	
"	d	6	3	4		14	20	17		3	17	10	
England, N.W.	a	57	50	54		45	30	38		73	43	58	
"	b	27	40	33	87	38	40	39	77	27	30	29	87
"	c	10	7	9		10	17	13		0	10	5	
"	d	6	3	4		7	13	10		0	17	8	
England, S.W.	a	50	50	50		46	45	46		67	50	59	
"	b	27	24	26	76	43	38	40	86	27	24	25	84
"	c	23	23	23		4	10	7		3	3	3	
"	d	0	3	1		7	7	7		3	23	13	
Ireland, N.	a	40	54	47		31	53	42		63	50	57	
"	b	50	40	45	92	45	27	36	78	30	27	28	85
"	c	7	3	5		17	13	15		7	7	7	
"	d	3	3	3		7	7	7		0	16	8	
Ireland, S.	a	44	47	46		38	43	41		63	54	59	
"	b	43	37	40	86	35	37	36	77	30	23	26	85
"	c	10	10	10		10	7	8		7	13	10	
"	d	3	6	4		17	13	15		0	10	5	

Summary.

British Isles	a	54	49	52		47	43	45		65	46	57	
"	b	31	34	33	84	37	33	35	80	29	26	28	85
"	c	11	13	12		10	10	10		4	9	7	
"	d	4	4	4		6	15	10		2	15	8	

Districts.		July 1886. Percentages. Wind.	Weather.	Average.	a+b.	August 1886. Percentages. Wind.	Weather.	Average.	a+b.	September 1886. Percentages. Wind.	Weather.	Average.	a+b.
Scotland, N.	a	58	48	53		49	58	54		35	48	42	
"	b	32	29	31	84	35	16	25	79	34	38	36	78
"	c	10	10	10		13	7	10		28	4	16	
"	d	0	13	6		3	19	11		3	10	6	
Scotland, E.	a	71	52	62		65	52	59		48	52	50	
"	b	19	35	27	89	26	32	29	88	31	21	26	76
"	c	10	3	6		9	13	11		14	7	11	
"	d	0	10	5		0	3	1		7	20	13	
England, N.E.	a	68	45	57		61	49	55		52	52	52	
"	b	23	42	32	89	26	35	31	87	31	24	28	80
"	c	6	7	7		13	3	8		7	7	7	
"	d	3	6	4		0	13	6		10	17	13	
England, E.	a	77	61	69		58	58	58		66	38	52	
"	b	13	20	17	86	29	23	26	84	24	38	31	83
"	c	10	13	11		13	10	12		7	17	12	
"	d	0	6	3		0	9	4		3	7	5	
Midland Cos.	a	55	52	54		58	58	58		66	31	49	
"	b	36	23	29	83	32	23	28	86	27	28	27	76
"	c	6	19	13		10	10	10		7	24	16	
"	d	3	6	4		0	9	4		0	17	8	
England, S.	a	71	55	63		55	68	62		59	55	57	
"	b	23	16	20	83	39	13	26	88	31	14	23	80
"	c	6	13	6		6	10	8		7	17	12	
"	d	0	16	11		0	9	4		3	14	8	
Scotland, W.	a	61	45	53		55	27	41		45	55	50	
"	b	39	23	31	84	26	47	37	78	31	17	24	74
"	c	0	23	12		10	6	8		7	14	11	
"	d	0	9	4		9	20	14		17	14	15	
England, N.W.	a	71	52	62		49	37	43		45	52	49	
"	b	23	19	21	83	35	37	36	79	34	34	34	83
"	c	6	16	11		6	6	6		14	7	10	
"	d	0	13	6		10	20	15		7	7	7	
England, S.W.	a	52	55	54		42	39	41		54	43	49	
"	b	35	19	27	81	32	26	29	70	35	32	33	82
"	c	13	16	14		20	13	16		7	7	7	
"	d	0	10	5		6	22	14		4	18	11	
Ireland, N.	a	42	42	42		58	49	54		41	46	44	
"	b	29	29	29	71	23	32	27	81	48	36	42	86
"	c	13	19	16		3	13	8		0	14	7	
"	d	16	10	13		16	6	11		11	4	7	
Ireland, S.	a	48	42	45		52	55	54		45	57	51	
"	b	10	42	26	71	26	35	30	84	44	36	40	91
"	c	23	13	18		9	7	8		4	0	2	
"	d	19	3	11		13	3	8		7	7	7	

Summary.

British Isles	a	61	50	56		55	50	53		50	46	49	
"	b	26	27	26	82	30	29	29	82	34	29	32	81
"	c	9	14	12		10	9	10		9	11	10	
"	d	4	9	6		5	12	8		7	12	9	

Districts.		October 1886. Percentages. Wind.	Weather.	Average.	a+b.	November 1886. Percentages. Wind.	Weather.	Average.	a+b.	December 1886. Percentages. Wind.	Weather.	Average.	a+b.
Scotland, N.	a	42	36	39		37	53	45		45	78	62	
"	b	39	32	36	75	47	27	37	82	23	19	21	83
"	c	16	19	17		10	17	14		23	3	13	
"	d	3	13	8		6	3	4		9	0	4	
Scotland, E.	a	42	42	42		30	30	30		48	55	52	
"	b	32	23	28	70	47	30	39	69	16	32	24	76
"	c	23	16	19		17	23	20		23	10	16	
"	d	3	19	11		6	17	11		13	3	8	
England, N.E.	a	39	48	44		44	40	42		49	45	47	
"	b	39	26	32	76	40	33	37	79	26	42	34	81
"	c	22	13	18		13	17	15		19	3	11	
"	d	0	13	6		3	10	6		6	10	8	
England, E.	a	49	32	41		37	33	35		36	35	36	
"	b	26	29	27	68	47	40	44	79	45	42	43	79
"	c	19	13	16		6	17	11		13	10	12	
"	d	6	26	16		10	10	10		6	13	9	
Midland Cos.	a	52	36	44		27	33	30		23	32	28	
"	b	19	39	29	73	43	44	44	74	48	36	42	70
"	c	26	6	16		20	13	16		19	19	19	
"	d	3	19	11		10	10	10		10	13	11	
England, S.	a	55	29	42		33	33	33		36	32	34	
"	b	26	42	34	76	43	47	45	78	35	32	34	68
"	c	16	16	16		17	10	14		19	16	17	
"	d	3	13	8		7	10	8		10	20	15	
Scotland, W.	a	29	30	30		27	33	30		36	36	36	
"	b	35	43	39	69	33	33	33	63	29	45	37	73
"	c	26	10	18		27	10	19		19	6	13	
"	d	10	17	13		13	24	18		16	13	14	
England, N.W.	a	42	64	53		37	37	37		36	52	44	
"	b	29	13	21	74	23	37	30	67	45	32	39	83
"	c	19	13	16		27	6	17		19	10	14	
"	d	10	10	10		13	20	16		0	6	3	
England, S.W.	a	39	37	38		50	43	47		58	52	55	
"	b	26	33	30	68	30	47	38	85	19	29	24	79
"	c	29	10	19		17	7	12		10	6	8	
"	d	6	20	13		3	3	3		13	13	13	
Ireland, N.	a	29	58	44		35	67	51		52	55	54	
"	b	39	26	32	76	45	20	33	84	32	29	30	84
"	c	19	10	15		17	7	12		10	0	5	
"	d	13	6	9		3	6	4		6	16	11	
Ireland, S.	a	39	58	40		42	64	53		39	35	37	
"	b	26	26	26	75	38	23	31	84	39	52	46	83
"	c	22	10	16		17	10	13		9	3	6	
"	d	13	6	9		3	3	3		13	10	11	

Summary.

British Isles	a	42	43	43		36	42	39		42	46	44	
"	b	30	30	30	73	40	35	38	77	32	35	34	78
"	c	22	12	17		17	12	14		17	8	12	
"	d	6	15	10		7	11	9		9	11	10	

Districts.		January 1887. Percentages.				February 1887. Percentages.				March 1887. Percentages.			
		Wind.	Weather.	Average.	a+b.	Wind.	Weather.	Average.	a+b.	Wind.	Weather.	Average.	a+b.
Scotland, N.	a	45	71	58		50	71	61		32	62	47	
,,	b	36	17	27	85	25	18	21	82	52	32	42	89
,,	c	13	6	9		14	0	7		10	3	7	
,,	d	6	6	6		11	11	11		6	3	4	
Scotland, E.	a	32	65	49		50	61	56		39	74	57	
,,	b	42	19	30	79	36	21	28	84	45	20	32	89
,,	c	23	6	15		11	7	9		13	3	8	
,,	d	3	10	6		3	11	7		3	3	3	
England, N.E.	a	43	39	42		54	50	52		55	74	65	
,,	b	39	39	39	81	46	32	39	91	39	26	32	97
,,	c	13	16	15		0	14	7		6	0	3	
,,	d	3	6	4		0	4	2		0	0	0	
England, E.	a	61	32	47		57	36	47		49	58	54	
,,	b	26	49	37	84	39	39	39	86	45	23	34	88
,,	c	13	19	16		4	14	9		3	16	9	
,,	d	0	0	0		0	11	5		3	3	3	
Midland Cos.	a	52	36	44		43	46	45		49	55	52	
,,	b	39	42	41	85	53	36	44	89	42	42	42	94
,,	c	9	19	14		4	7	6		3	3	3	
,,	d	0	3	1		0	11	5		6	0	3	
England, S.	a	52	52	52		64	50	57		42	52	47	
,,	b	45	29	37	89	32	39	36	93	49	29	39	86
,,	c	3	19	11		4	7	5		6	19	13	
,,	d	0	0	0		0	4	2		3	0	1	
Scotland, W.	a	42	28	40		46	54	50		42	39	41	
,,	b	31	35	33	73	22	21	22	72	39	35	37	78
,,	c	24	10	17		25	18	21		13	10	11	
,,	d	3	17	10		7	7	7		6	16	11	
England, N.W.	a	33	40	37		57	54	56		36	52	44	
,,	b	37	33	35	72	22	29	25	81	45	36	41	85
,,	c	17	20	18		14	3	9		16	6	11	
,,	d	13	7	10		7	14	10		3	6	4	
England, S.W.	a	43	37	40		64	57	61		39	36	38	
,,	b	30	43	37	77	22	25	23	84	36	39	37	75
,,	c	20	13	16		7	0	4		19	19	19	
,,	d	7	7	7		7	18	12		6	6	6	
Ireland, N.	a	40	52	46		57	43	50		42	52	47	
,,	b	33	38	36	82	29	46	38	88	39	36	38	85
,,	c	20	3	11		11	4	7		16	6	11	
,,	d	7	7	7		3	7	5		3	6	4	
Ireland, S.	a	30	48	39		47	32	40		39	52	46	
,,	b	30	42	36	75	39	50	44	84	33	29	30	76
,,	c	23	3	13		7	7	7		10	3	7	
,,	d	17	7	12		7	11	9		19	16	17	

Summary.

British Isles	a	43	47	45		54	51	53		42	55	49	
,,	b	35	35	35	80	33	32	32	85	42	32	37	86
,,	c	16	12	14		9	7	8		11	8	9	
,,	d	6	6	6		4	10	7		5	5	5	

APPENDIX XII.

LIST of STATIONS from which DAILY SIMULTANEOUS OBSERVATIONS (at 0h. 8m. p.m. G. M. T.) have been received in 1886.

Stations.	Observers.	Remarks.
ENGLAND AND WALES.		
Bradford - -	J. McLandsborough, F.R.A.S., F.R. Met. Soc. and A. E. Preston, F.R. Met. Soc.	—
Chatham, School of Military Engineering.	W. Saunders, Bugler, R.E.	—
Falmouth Observatory -	The Staff.	—
Greenwich Observatory -	The Staff, for the Astronomer Royal.	—
Guernsey - -	A. Collenette, F.R. Met. Soc.	—
Kew Observatory -	The Staff.	—
Leicester (Museum) -	J. C. Smith.	—
Liverpool Observatory (Bidston).	J. Hartnup, F.R. Met. Soc.	—
Oxford, Radcliffe Obs. -	The Staff.	—
Plymouth - -	J. Merrifield, LL.D., F.R.A.S.	—
Stonyhurst Observatory -	The Staff.	—
SCOTLAND.		
Aberdeen Observatory -	The Staff.	—
Orkney, Swanbister -	W. I. Fortescue.	—
IRELAND.		
Galway, Queen's College	W. Ryan.	—
Valencia Observatory -	The Staff.	—
BRITISH COLONIES, POSSESSIONS, &c.		
Barbados, W. I. - -	Surgeon-Maj. in charge.	—
Gibraltar - -	Surgeon-Gen. in charge.	—
Malta - - -	Q. R. Willan.	—
Nassau (Bahamas) -	J. A. Kerr	—
Natal - - -	Surgeon-Maj. in charge.	—
Scutari, British Cemetery	Serg. W. H. Lyne, R.E.	—
Sierra Leone - -	Surgeon-Maj. in charge.	—

SUMMARY.

—	—
England and Wales -	11
Scotland - - -	2
Ireland - - -	2
British Colonies and Possessions - -	7
Total	22

APPENDIX XIII.

METHODS FOLLOWED IN DEALING WITH METEOROLOGICAL RETURNS FROM LAND STATIONS IN THE BRITISH ISLES.

These stations are of five classes, as stated on page 16.

I.—*Observatories continuously observing all the Meteorological Elements.*

Returns from observatories.

Hourly measurements of the curves obtained from the self-recording instruments at the observatories of the Office are made by the observers at each station, on printed forms supplied for the purpose, which, together with the curves, are forwarded to the Office weekly. They comprise measurements of the barograms, of the dry-bulb and wet-bulb thermograms, of the anemograms, and of the rain-gauge curves.

Examination of returns.

The measurements are subjected to a careful examination in order to ensure as far as possible their accuracy, and the regulations which have been adopted to secure this end are in the main the same as those which will be found in the Report of the Office for 1868. They comprise rules for the guidance of observers, as well as of the assistants charged with the examination of the work at the Office. Attention need be called here to only two of these rules, viz.: (*a*) the use of subsidiary sheets on which are entered the results of a second set of measurements of the curves, made after, and quite independently of, the first set, and with a different scale, the two sets of measurements being afterwards compared together, and any differences found inquired into and set right; and (*b*) the re-measurements of the curve made by the assistants at the Meteorological Office, and which always amount to 40, and in doubtful cases to many more, per month, for each element. The attention of the observers is always drawn to such errors as may be detected, and to any failures in the continuity of the curves arising from failure of the light, stoppage of the clock, defective photography, faulty action of the wet-bulb thermometer, &c.; a report containing the results of the examination of each Observatory being also submitted to the Council each month. The curves and tabulations are eventually bound and stored in the Office.

Results of examination and report to Council.

General supervision of observatory work.

In connexion with this work should be mentioned the general watch which has to be kept over the working of the observatories and of the instruments, not only to secure uniformity amongst them and observance of rules, but also to guard against small changes which are liable to occur at certain times, especially with the thermographs, and which may affect the scale-values of the instrument or the datum lines used for the tabulation of the curves. About twice a year this work calls for special examination, entailing some considerable time and occasionally the engraving of new scales for measuring the curves.

Harmonic analyser.

The photographic curves are also used in the harmonic analyser; and for this purpose the barograms require a slight special preparation.

METHOD OF DEALING WITH THE NUMERICAL RESULTS FROM THE SELF-RECORDING OBSERVATORIES.

Interpolations.

In dealing with the tabulations the first step is to go over the sheets and fill up by interpolation, wherever possible, any gaps or breaks in the continuity of the record.

Means.

The record having been made as complete as possible, the daily, five-daily, and monthly means of the barometer and of the dry-bulb and wet-bulb thermometers are deduced.

The hourly vapour tension is then computed by an expansion of Glaisher's Hygrometrical Tables, prepared in the Office, and the work is independently checked. Vapour tension.

A copy is next prepared of the above-mentioned hourly measurements of the barometer, dry-bulb and wet-bulb thermometers, wind and rain curves, and of the computed values of vapour tension. To these are added the daily means of the three first-mentioned elements, the extremes and daily range of pressure and temperature, and the daily totals of rainfall, and the whole series is printed and published under the title of "Hourly Readings from the Self-recording Instruments "at the Four Observatories under the Meteorological Council." Hourly Readings.

To ensure accuracy the sheets are read over in proof with the original measurements of the curves. The interpolated readings are printed in *italic* type, but no distinguishing mark is affixed to means which are partly based on them. When the gap in the record is too long to be dealt with by an interpolation of the missing hourly readings, the mean for the day is obtained either from the maximum and minimum readings for the day, or by an interpolation from the adjacent daily means, and the result thus obtained is printed as an approximation.

The five-daily, monthly, and annual means, together with the absolute extremes of pressure and temperature for each month, are printed as part of the "Hourly Readings." The tables are repeated in French measures. Tables for the Quarterly Weather Reports.

The gale tables printed in the text of the Quarterly Weather Report, which show the extent, duration, and degree of severity of all the stronger gales, are prepared from the tabulations of the anemograms received from the self-recording observatories, together with those received from the extra anemographic stations. Gale tables.

II.—*Anemographic Stations at which the Wind is recorded continuously.*

The anemograms received from the stations enumerated on page 92 are regularly examined and tabulated in the Office, and the sheets bound up in volumes. Besides special inquiries on legal and other points that from time to time arise, and in which these documents are of the highest importance, the tabulations are always employed in the preparation of the summary of weather and gale tables for the Quarterly Weather Report. They are also regularly used in the checking of the Storm Warnings issued by the Office.

III.—*Method followed with regard to the Returns from Land Stations of the Second Order.*

Ever since the year 1866 returns of more or less completeness have been received from land stations in the United Kingdom. In that year there was only one station, but by 1871 the number had increased to 15, and five years later to 49, including 14 stations belonging to the Royal Meteorological Society, copies of the returns from which were sent to the Office under a special arrangement with the Society. Origin and progress of system.

At the end of the present year the total number of stations was 73, including 16 belonging to the Royal Meteorological Society and 5 belonging to the Scottish Meteorological Society.

This number is exclusive of the self-recording observatories, and of the anemographic stations, but it includes several from which only very scanty information is received.

The stations are distributed as follows: 43 in England, 3 in Wales, 11 in Scotland, and 16 in Ireland.

The returns are received at the Office monthly, and are duly entered and stored.

Publication on Form A.

The publication of the returns is carried out in the following way: For a certain number of stations the observations of pressure (to the second place of decimals), temperature, wind, cloud amount, and weather, at 9 a.m. and 9 p.m. each day, together with the computed vapour tension and relative humidity at those hours, and the daily maxima and minima of temperature, and daily rainfall, are published *in extenso* on the Form, A., proposed by the Permanent Committee of the First International Meteorological Congress at Vienna in 1874, and adopted for international use by the Second International Meteorological Congress at Rome in 1879.

The Permanent Committee assigned an inferior limit to the number of stations from which returns should be published *in extenso*, varying from two for Belgium to 100 for Russia in Asia, the number in the case of the United Kingdom being 15. In 1875, when the systematic publication of returns from Stations of the Second Order began, only nine British stations were available, but this number has steadily grown, until for 1880 returns from 33 stations were published on the A. Form. Though this list could be extended if desired, it has been thought better to curtail it somewhat on account of the size of the publication. The volume for 1883, now passing through the press, will therefore, like that for 1881 and 1882, contain returns, *in extenso*, from only 30 stations.

Additions to the list for publication.

Care is taken in adding to the list for publication to see, first, that the station is satisfactory as regards its instruments, their exposure, &c.; secondly, that the returns bear internal evidence of accuracy and care in their preparation; and thirdly, that the district represented by the station is one for which information is needed.

Examination.

Full particulars as to the methods adopted in the examination of the returns will be found in previous reports.

Publication on Form B.

Besides this publication in full, the monthly means of the various elements, together with summaries of the wind direction and of the weather, are published on the Form, B., also devised by the Permanent Committee of the Vienna Congress, and adopted by the Roman Congress.

Returns from six stations were published in this manner for the year 1873, and from nine stations for the year 1874. In 1875 the list included the names of 26 stations. This number has grown to 45 for the year 1883, and might be even further increased.

All the stations, returns from which are published *in extenso* on Form A., are included in the Form B. list. But this list also includes others, either not quite so good, not so representative, or not so long established. The method of preparation is in the main the same as in the case of the Form A. But the summaries of wind and weather are specially prepared for this publication. For wind, the summary shows the number of *observations* at 9 a.m. and 9 p.m. under each of the semi-quadrantal points N., N.E., E., &c., the observations under intermediate points being thrown alternately forward and backward. For weather, the summary gives the number of *days* of rain, snow, hail, thunderstorm, clear sky, overcast, and gale. The days of clear sky and overcast are those when the means of the cloud-amounts at 9 a.m. and 9 p.m. are less than 2, and more than 8 respectively. The days of gale are those when force 7 or upwards, by Beaufort scale, is recorded.

British rainfall.

The monthly rainfall values (total, number of rainy days, and maximum) for the observatories and all the Stations of the Second Order are supplied each year to Mr. Symons, F.R.S., for publication in his "British Rainfall."

Unpunctual observations.

The observations are taken at 9 a.m. and 9 p.m. local time each day. It sometimes happens, however, that strict punctuality cannot be observed.

In such cases, if the difference in time does not exceed 30 minutes, the observations are, in most cases, printed without alteration. When the difference exceeds 15 minutes, a note is inserted in the remarks showing the exact time of observation. If the difference in time is more than half-an-hour, the readings are usually rejected and an interpolation made.

New stations. When an application for the adoption of a new station is received, a schedule is forwarded to the observer containing a series of questions as to the outfit of the station, the exposure of the instruments, and the influence likely to be exerted on their indications by surrounding objects, such as houses and trees. Only mercurial barometers are accepted, and only such as have been duly verified. All thermometers must have been tested at Kew. A plan of the station, showing the positions of the instruments with regard to neighbouring objects is also required.

On the return of this schedule the answers are considered, and, where necessary, alterations are advised.

If, however, the existing arrangements are satisfactory, tables for reducing the barometer readings to 32° Fahrenheit at mean sea level are prepared and duplicates sent to the observer, together with a set of Hygrometrical Tables, and a copy of "Instructions in the Use of Meteorological Instruments."

The first returns are compared and examined with special care, and a report of the result of the examination is forwarded to the observer, with instructions how best to complete and perfect the returns.

Sunshine records. The daily records of sunshine which are now received from 35 Stations in the British Islands are examined generally to guard against accidental changes in the adjustment of the instrument. Notes explaining any omission or accidental defect are added to the cards if required, and after their receipt has been acknowledged, they are duly stamped and dated and then stored in the Office.

Weekly totals. A tabulation of these curves is published as part of the Weekly Weather Report, mentioned in Appendix VII., and for those stations which are also Stations of the Second Order the monthly totals of bright sunshine in hours, together with the percentage of its possible duration, is published as Part IV. of "Returns from Stations of the Second Order." A table showing the daily amount of sunshine at Bunhill Row, one of the London stations, is also prepared quarterly for the Royal Meteorological Society.

Inspection.

The Stations of the Second Order are regularly inspected, the attention of the inspector being directed by the Office to any special point which may require investigation.

IV.—*Telegraphic Reporting Stations.*

Full particulars relating to these stations, the information received from them, and the method of dealing with that information, will be found in Appendix VII. A paragraph in that Appendix (p. 70) explains the use that is made of the monthly schedules sent in by the observers.

V.—*Extra Stations.*

No returns from Stations of the Fifth Class are published by the Office, but some of them are regularly used in the checking of the Storm-Warnings, and all are available for any special investigation that may be taken up.

The rainfall values at these stations are, however, copied and supplied to Mr. Symons, F.R.S., for publication in "British Rainfall."

APPENDIX XIV.

List of Documents relating to the Land Meteorology of the British Islands, received during the Year ending March 31st, 1887.

	Stations.	Observers.	Nature of Information received.	Notes.
I.	†Valencia	J. E. Cullum	Continuous records of pressure, temperature, wind, sunshine, and rain, with notes on the weather.	
	†Glasgow	Prof. R. Grant, M.A., LL.D., F.R.S.		
	†Aberdeen	Prof. C. Niven, M.A., F.R.S.		
	†Falmouth	E. Kitto, F.R. Met. Soc.		
	†Stonyhurst	Rev. S. J. Perry, S.J., F.R.S.		
	†Kew	G. M. Whipple, B.Sc., F.R.A.S., F.R. Met. Soc.		
II.	†Armagh	J. L. E. Dreyer, Ph.D., F.R.A.S.	Continuous record of wind, rainfall, and sunshine.	
	Alnwick Castle	Lt.-Col. F. Holland, for the Duke of Northumberland, K.G.	Continuous record of wind (direction and velocity).	
	†Fleetwood	M. S. Gaulter, C.E.	" "	From September 1886.
	†Holyhead	Hugh Williams, C.E.	" "	
	†North Shields	Capt. W. Harrison	" "	From September 1886.
	†Swanbister (Orkney)	W. I. Fortescue, Esq.	" "	
	†Scilly	W. Thomas	" "	
	†Yarmouth	G. T. Watson	" "	
	Kilkenny Castle	The Marquis of Ormonde	Continuous record of pressure.	
	Waterford	The Harbour Authorities	" "	
III.	†Armagh	J. L. E. Dreyer, Ph.D., F.R.A.S.	Regular observations at 9 a.m. and 9 p.m. of pressure, temperature (dry-bulb and wet-bulb), wind, cloud and weather, with the daily maxima and minima of temperature, the daily rainfall, and general remarks on the weather.	
	Aysgarth	Rev. Fenwick W. Stow, M.A., F.R. Met. Soc.		
	Babbacombe, Devon	E. E. Glyde, F.R. Met. Soc.		
	Benniogton, Herts.	Rev. J. Dunne Parker, LL.D., F.R. Met. Soc.		
	†Braemar	James Aitken, J.P.		
	†Brookborough (Colebrooke Park).	W. Ferguson, for Sir Victor Brooke, Bt., F.L.S.		
	Buxton	E. J. Sykes, M.B., F.R.A.S., F.R. Met. Soc.		
	Carmarthen	G. J. Hearder, M.D.		
	Cheadle	J. C. Philips, Esq.		

LIST OF DOCUMENTS—*continued.*

Stations.	Observers.	Nature of Information received.	Notes.
Cheltenham	R. Tyrer, B.A., F.R. Met. Soc.	Regular observations at 9 a.m. and 9 p.m. of pressure, temperature (dry-bulb and wet-bulb), wind, cloud and weather, with the daily maxima and minima of temperature, the daily rainfall, and general remarks on the weather.	
Churchstoke	Philip Wright, F.C.S., F.R. Met. Soc.		
†Cronkbourne, Isle of Man.	A. W. Moore, M.A., J.P.		
†Douglas, Isle of Man	Thos. Keig, Esq.		From June 1886.
†Dublin (Botanic Gardens, Glasnevin).	F. W. Moore, Esq.		
†Dublin (City)	J. W. Moore, M.D., F.R. Met. Soc.		
†Dublin (Mountjoy Observatory).	Sergt. Lipscombe, for Lt.-Col. A. B. Coddington, R.E., Ordnance Survey Office.		
†Dundee	W. Ross McKelvie, Esq.		
†Dunrobin Castle	D. Melville		
†Durham	H. J. Carpenter, Esq.		
†Epsom (Royal Med. College).	J. S. Jackson, Esq.		
†Geldeston (Beccles)	E. T. Dowson, F.R. Met. Soc.		
†Glasgow	Prof. R. Grant, M.A., LL.D.		
†Glenalmond	Arthur S. Reid, M.A., F.G.S.		
Hillington, Norfolk	Rev. H. E. B. Ffolkes, M.A., F.R. Met. Soc.		
Killarney	The Ven. Archdeacon G. R. Wynne, M.A., F.R. Met. Soc.		
†Laudale (Argyleshire)	A. Fletcher, for T. H. G. Newton, M.A., J.P., F.R. Met. Soc.		
†Leicester	J. C. Smith, for Museum Authorities		
Llandudno	J. Nicol, M.D., J.P., F.R. Met. Soc.		
†Londonderry	J. Conroy, F.R. Met. Soc.		
Margate	J. Stokes, F.R. Met. Soc.		
†Markree Castle, Sligo	A. Marth, F.R.A.S., for Col. Cooper, F.R.A.S.		
Marlborough	C. E. B. Hewitt, B.A., F.R. Met. Soc.		From January 1887.

LIST OF DOCUMENTS—*continued.*

Stations.	Observers.	Nature of Information received.	Notes.
†Newton Reigny (Penrith).	T. G. Benn, F.R. Met. Soc.	Regular observations at 9 a.m. and 9 p.m. of pressure, temperature (dry-bulb and wet-bulb), wind, cloud and weather, with the daily maxima and minima of temperature, the daily rainfall, and general remarks on the weather.	
†Parsonstown	Benj. Budds, for the Earl of Rosse, F.R.S.		
⛐†Pinmore	Peter Donald		
Prestwich (Manchester)	T. R. H. Clunn, M.D., F.R. Met. Soc.		
⛐†Rothesay	James Kay, Esq.		
⛐ Scaleby	R. A. Allison, M.P., F.R. Met. Soc.		Till December 1886.
⛐ Scarborough	Allan Rowntree, F.R. Met. Soc.		
†Seaham	G. H. Aird		
†Southampton	J. T. Cook, R.E., for Director General of the Ordnance Survey.		
⛐ Southbourne	T. A. Compton, B.A., M.D., F.R. Met. Soc.		
Stokesay	Miss M. A. Digges La Touche		
†Stonyhurst	Rev. S. J. Perry, S.J., F.R.S.		
†St. David's, Pembroke	W. P. Propert, LL.D., F.G.S., F.R. Met. Soc.		
†St. Leonards	H. Colborne, M.R.C.S.		
†Swanbister	W. I. Fortescue, Esq.		
Uppingham	Rev. G. H. Mullins, M.A., F.R. Met. Soc.		
⛐ Wakefield	H. Clarke, L.R.C.P., F.S.S., F.R. Met. Soc.		
†Whitby (Lighthouse)	E. J. W. Powell		
†York	J. Wright, for H. M. Platnauer, F.G.S.		
IV. The Telegraphic Stations, see List on page 50		Regular observations twice (and in some cases three times) daily of pressure, temperature, wind, weather, and sea disturbance.	
V. † Arlington Court, Devon	J. Carter, for Lady Chichester	Pressure, temperature (dry-bulb, wet-bulb, max., min.), wind and rainfall, once daily.	
Baltimore	J. Halsey	Pressure, temperature, wind, and weather, once daily.	
Castletownsend	Lieut. T. W. Cobb, R.N.	Pressure and temperature four times daily, and wind twice daily.	
Crookhaven	" "		

LIST OF DOCUMENTS—*continued.*

Stations.	Observers.	Nature of Information received.	Notes.
†Chatham School of Military Engineering.	P. McHugo, for Inspector in Survey - -	Full return for 9 a.m.	
Cooper's Hill (Egham)	Prof. H. McLeod, F.R.S. - - -	Full return for 9 a.m. and 3 p.m.	
Crosshaven - -	J. W. Bridle - - - -	Pressure, temperature, and wind, twice daily.	
Delph, Yorkshire -	W. K. Inglis - - - - -	Pressure, wind, and weather twice daily, with max. and min. temperatures, and rainfall.	
Ennis -	J. Hill, C.E., F.R. Met. Soc. - - -	Daily rainfall.	
Gorleston, Norfolk -	R. J. C. Day - - -	Pressure and wind twice daily.	
Harpenden - -	T. Wilson, F.R. Met. Soc. - - -	Pressure, temperature, and wind, twice daily, with rainfall.	
Haslar - -	G. Coppen - - - - -	Pressure and temperature four times daily.	
Killarney Asylum -	Oscar T. Woods, M.D. - - -	Daily rainfall.	
Rugby - -	C. H. Hodges, M.A. - - - -	Full set of 9 a.m. observations with 9 p.m. temperatures.	
Saffron Walden -	J. G. Bellingham - - - -	Pressure and temperature twice daily, with 9 a.m. wind and rainfall.	
Schull - -	Lieut. T. W. Cobb, R.N. - - -	Pressure, temperature, and wind twice daily.	
†Sheffield (Weston Park)	Elijah Howarth, F.R.A.S. - - -	Full returns for 9 a.m. and 6 p.m.	
Stamford (Ketton Hall)	Fred. Coventry, F.R. Met. Soc. - -	Full monthly summary.	
Sudbury - -	W. Bayley Ransom - - - -	Pressure, temperature (dry-bulb, max., min.), wind, cloud, and rainfall, once daily, with general remarks.	
Symbister, Shetland -	J. S. Nicolson - - - -	Pressure and temperature twice daily.	
Tarbert (Harris) -	Donald Bethune - - - -	Pressure and wind twice daily.	
Union Hall - -	Lieut. T. W. Cobb, R.N. - - -	Pressure, temperature, and wind, twice daily.	

NOTE.—The Stations marked "𝔐" belong to the Royal Meteorological Society; those marked "𝔖" belong to the Scottish Meteorological Society; those marked thus † have been inspected during the year.

LIST of STATIONS from which CONTINUOUS RECORDS of BRIGHT SUNSHINE have been received.

Station.	Observer.
Aberdeen	Prof. C. Niven, M.A., F.R.S.
Armagh	J. L. E. Dreyer, Ph.D., F.R.A.S.
Blackpool	Hy. Welch, M.B.
Cambridge	H. Todd.
Churchstoke	P. Wright, F.C.S., F.R. Met. Soc.
Cirencester	Prof. Ohm., B.A., F.R. Met. Soc.
Cronkbourne, Isle of Man	A. W. Moore, M.A., J.P.
Cullompton	Thos. Turner, J.P., F.R. Met. Soc.
Dublin	A. B. Coddington, Lt. Col. R.E.
Durham	H. J. Carpenter.
Falmouth	E. Kitto, F.R. Met. Soc.
Geldeston, Beccles	E. T. Dowson, F.R. Met. Soc.
Glasgow	Prof. R. Grant, M.A., LL.D., F.R.S.
Hastings	H. Colborne, M.R.C.S.
Hillington	Rev. H. E. B. Ffolkes, M.A., F.R. Met. Soc.
Jersey (Noirmont)	J. Fisher.
Kew Observatory	G. M. Whipple, B.Sc., F.R.A.S.
Leicester	J. C. Smith.
Llandudno	J. Nicol, M.D., J.P., F.R. Met. Soc.
London, Bunhill Row	Messrs. de La Rue.
„ Westminster	The Staff, Meteorological Office
Markree Castle	A. Marth, F.R.A.S.; for Col. E. H. Cooper.
Newton Reigny (Penrith)	T. G. Benn, F.R. Met. Soc.
Oswald Kirk, Yorkshire	R. Thompson.
Oxford	E. J. Stone, F.R.S.
Parsonstown	O. Boeddicker, Ph.D.; for the Earl of Rosse, F.R.S.
Plymouth	J. Merrifield, LL.D., F.R.A.S.
St. Ann's Head	Messrs. Blake & Spicer.
Southampton	Sir C. Wilson, Col. R.E., K.C.B., F.R.S.
Stonyhurst	Rev. S. J. Perry, M.A., F.R.S.
Stornoway	D. Macdonald.
Swanbister (Orkney)	W. Irvine Fortescue.
Valencia	J. E. Cullum.
Worksop	H. Mellish, F.R. Met. Soc.
York	J. E. Clarke, B.A., B.Sc.

APPENDIX XV.

ACCESSIONS TO THE LIBRARY DURING THE YEAR ENDING 31ST MARCH 1887.

A—AGRICULTURE AND BOTANY.

Chambers, F.—Variations of the prices of staple food grains in the Bombay Presidency. 20 pp., 4 diagrams, sm. f°. (Bombay, 1886.)

Commissioner of Agriculture, Washington.—Report. 1885. 1 vol., with plates, la. 8°. Washington, 1885.

Kihlman, A. O.—Beobachtungen über die periodischen Erscheinungen des Pflanzenlebens in Finnland 1883. Herausegegeben von Societas pro Fauna et Flora fennica. xxxii. + 97 pp. 4°. Helsingfors, 1886.

Ufficio centrale di Meteorologia, Roma.—Rivista Meteorico-Agraria. Anno VII., 1886, Nos. 1-36. la. 8°. (Roma, 1886-87.)

‖ **Wollny, E.**—Untersuchungen über die Feuchtigkeits- und Temperaturverhält. nisse des Bodens bei verschiedener Neigung des Terrains gegen den Horizont. 70 pp. 8°. (*Forschungen auf dem Geb. Agrik.-phys., Heidelberg, Bd.* ix., *Heft* 1.)

B—ASTRONOMY.

‖ **Davis, W. M.**—Bishop's ring around the sun. 8 pp. la. 8°. (*Pop. Sc. Monthl.*, 1886, *Feb., p.* 466.)

Royal Astronomical Society, London.—Monthly Notices . . . from November 1885 to November 1886. Vol. xlvi., with plates, 8°. London, 1886.

Royal Observatory, Greenwich.—Report of the Astronomer Royal to the Board of Visitors of the Royal Observatory, Greenwich, read at the annual visitation of the Royal Observatory, 1886, June 5. 19 pp. la. 4°. s.l.e.a.

‖ **Stewart, B. and Carpenter, W. L.**—On a comparison between apparent inequalities of short period in sun-spot areas and in diurnal declination-ranges at Toronto and at Prague. 16 pp. 8°. (*Proc. R. Soc.*, 1886, *No.* 243.)

United States Naval Observatory.—Astronomical and meteorological observations made during the year 1882, at the United States Naval Observatory. Vice-Admiral **S. C. Rowan**, Superintendent. lxiii. + 198 + 21 + 82 + 34 + 28 pp., 3 plates, la. 4°. Washington, 1885.

C—ATMOSPHERIC PRESSURE.

‖ **Hann, J.**—Bemerkungen zur täglichen Oscillation des Barometers. 14 pp. la. 8°. (*Sitzb. k. Akad. Wissensch., Wien. Bd.* xciii., *Abth.* ii., 1886, *p.* 981.)

‖ **(Hann, J.)**—Vieljährige Luftdruckmittel für Hong-Kong. 2 pp. sm. f°. (*Meteor. Zeitschr.* 1886. *July, p.* 321.)

Hong Kong Observatory.—Results of barometric observations made during 25 years in Hong Kong. sm. f°. Sheet. (*Gov. Notification, No.* 142.)

* **(Köhler, W.)**—On the influence of fluctuations of atmospheric pressure on the evolution of fire-damp. Report of experiments concerning this question carried on in the Archduke Albert's Coal Mines near Karwin in Austrian Silesia. Translated from the second German edition by **G. G. Bagster.** 18 pp., 12 plates, la. 4°. Vienna and Teschen, 1886.

* **Le Chatelier, H.**—De l'influence des changements de pression atmosphérique sur le dégagement du grisou. 19 pp., 2 plates, 8°. (*Paris, s.a.*)

Schokker, A. E. A.—Les perturbations atmosphériques étudiées au moyen d'observations horaires. 16 pp., 6 plates, sm. f°. Utrecht, 1886.

NOTE.—Books marked * have been acquired by purchase; the others are donations from institutions, societies, or authors. Those marked ‖ are excerpt papers, extra copies of which have been separately printed.
In some cases additional publications have been received besides those specified, but only completed volumes or years are given here.

D—AURORA.

Académie royale des sciences de Suède.—Observations faites au Cap Thordsen, Spitzberg, par l'expédition Suédoise. Tome II. i. Aurores boréales par Carlheim-Gyllenskiöld. 1 vol., with plates, la. 4°. Stockholm, 1886.

——. **The aurora borealis.**—32 pp. 8°. (*Edinb. Rev.*, 1886, *Oct.*, *No.* 336.)

‖ **Sundell, A. F.**—Om norrskenet den 1 April 1886. 2 pp. 8°. (Helsingfors, 1886.) (*Finska Vetensk. Soc. Förh.*, xxvii.)

F—CLIMATE AND HYGIENE.

* **Hooper, G. S.**—Observations on the topography, climate, and prevalent diseases of the Island of Jersey, the result of meteorological observations, and general practice, during thirteen years. 199 + 8 pp. la. 8°. London, 1837.

Inspector General of Customs, Peking.—Medical reports, for the half years ended 30th September, 1885, and 31st March, 1886. 30th and 31st Issues. 2 vols., with plates, 4°. Shanghai, 1886.

‖ **Lancaster, A.**—Le climat de la Belgique en 1886. 73 pp., 2 plates, sm. 8°. Bruxelles, 1887. (*Ann. Obs. R. Bruxelles*, 1887.)

‖ **Liznar, J.**—Ueber das Klima von Brünn. 70 pp., 4 plates, la. 8°. Brünn, 1886. (*Verhandl. naturf. Ver. Brünn*, xxiv.)

* **Mackenna, B. V.**—Ensayo histórico sobre el clima de Chile. (Desde los tiempos prehistóricos hasta el gran temporal de Julio de 1877.) ix. + 490 pp. sm. 4°. Valparaiso, 1877.

‖ **Marcet, W.**—On the distribution and object of carbonic acid in nature, and its sanitary relations. On the influence of altitude on the chemical phenomena of respiration. 16 pp. 8°. (*Trans. San. Inst. Gt. Brit.*, vii.)

‖ **Physiographical Commission of the I. R. Academy of Science at Cracow.**—Materials for Galician climatology, collected by the Meterological section . . . 1882, 1885. 2 vols. la. 8°. Cracow, 1883, 1886. (*Extract Rep. Physiogr. Comm.*)

In the Polish language.

‖ **Piche, A.**—Les méthodes d'investigation scientifique et leur application à la science des climats. Communication faite au congrès de Biarritz. 15 pp. 8°. Bruxelles, 1887. (*Ciel et Terre*, 2 *serie*, *t. II.*, 1887.)

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|| **Prestwich, J.**—On underground temperatures; with observations on the conductivity of rocks; on the thermal effects of saturation and imbibition; and on a special source of heat in mountain ranges. Read Feb. 12, 1885. 82 pp. la. 4° London, 1886. (*Proc. R. Soc.*, xxxviii., 1885, *p.* 161.)

Prince, C. L.—Some remarks upon the temperature of the winter of 1885–86 3 pp. sm. f°. Dated, Crowborough, April 28th, 1886.

* || **Schlagintweit, H.**—Atmosphärische Feuchtigkeit. pp. 398–425, la. 8°. [? Where from.]

Wahlén, E.—Wahre Tagesmittel und tägliche Variation der Temperatur an 18 Stationen des Russischen Reiches. Dritter Supplementband zum Repertorium für Meteorologie herausgegeben von der kaiserlichen Academie der Wissenschaften. xxi. + dxxxvi. pp. la. 4°. St. Petersburg, 1887.

|| **Wild, H.**—Weitere Versuche über die Bestimmung der wahren Lufttemperatur. Der Akad. vorgelegt am 21 Oct. 1886. 24 pp. sm. f°. (St. Petersburg), 1887. (*Repert. Meteor.*, x., *No.* 10.)

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Hong-Kong Observatory.—On the practical use of the meteorological signals. sm. f°. Sheet. Dated, 11th April 1886.

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|| **Rotch, A. L.**—An experiment in local weather prediction. 4 pp. la. 8°. (*Amer. Meteor. Journ.* 1887, *Feb.*)

* **Saxby, S. M.**—Saxby's weather system or lunar influence on weather Second edition. viii. + 119 pp., sm. 8°. London, 1864.

Teisserenc de Bort, L.—La prévision du temps. Conférence faite au Congrès de climatologie de Biarritz, le 4 Oct. 1886. 15 pp. 8°. (*Ciel et Terre*, 2e *série*, 2e *année*, *No.* 19, 1886, *p.* 433.)

* **Weather-Book, The.**—Three hundred plain rules for telling the weather; by the barometer, thermometer, hygrometer, clouds, winds, animals, plants, &c. 64 pp. 18°. London, 1841.

Zenger, K. W.—Die Meteorologie der Sonne und die Wetter-Prognose des Jahres 1886. xi. + 52 pp., 1 plate, la. 8°. Prag, 1887.

Y—WINDS, STORMS, AND CYCLONES.

|| **Augustin, F.**—Über die jährliche Periode der Richtung des Windes. 22 pp., 1 plate, 8°. Prag, 1886. (*Sitzungsb. königl. böhm. Gesellsch. Wissensch.*, 1886. *Marz* 12.)

* **Bassnett, T.**—Outlines of a mechanical theory of storms, containing the true law of lunar influence, with practical instructions to the navigator, to enable him approximately to calculate the coming changes of the wind and weather, for any given day, and for any part of the ocean. 246 pp. sm. 8°. New York, 1854.

|| **Cloué, G.**—L'ouragan de Juin 1885 dans le Golfe d'Aden. 67 pp., 1 plate, la. 8°. Paris, 1886. (*Rev. mar. col.*, 1886, *Avril.*)

(Davis, W. M.)—Cyclones, anticyclones, and pericyclones. 2 pp. la. 8°. (*Amer. Meteor. Journ.* iii., 1886, *p.* 117.)

Dechevrens, M.—L'inclinaison des vents. Un anémomètre pour observer cette inclinaison, avec un appendice sur les courants verticaux dans les cyclones. Deuxième note. 48 pp., 3 plates, la. 4°. [Zi-ka-wei], 1886.

(Doberck, W.)—Report on the typhoons of 1884 and 1885. Government Notification No. 392. 18 pp., 6 plates, sm. f°. Dated, Hong-Kong Observatory, 1886.

|| **Doberck, W.**—The law of storms in the eastern seas. 24 pp., 1 plate, sm. 8°. Dated, Sept. 1886. ("*Hong-Kong Telegraph.*")

* || **Fournet, —.**—Recherches sur la distribution des vents dominants en France. pp. 417–456, la. 8°. [?]

(Gibson, H. B.)—Water-spouts on the gulf stream in winter. 9 pp. la. 8°. (*Amer. Meteor. Journ.*, iii., 1886, *p.* 119.)

|| **Harding, C.**—The gale of October 15 and 16, 1886, over the British Islands. 12 pp. la. 8°. (*Quart. Journ., R. Meteor. Soc.*, xiii., 1887.)

|| **Hirn, G. A.**—Étude sur une classe particulière de tourbillons qui se manifestent, sous de certaines conditions spéciales, dans les liquides. Analogie existant entre le mécanisme de ces tourbillons et celui des trombes. 40 pp., 3 plates, 8°. Paris, 1878. (*Bull. Soc. hist. nat. Colmar.*)

* || ———.—Remarques sur les effets singuliers d'un coup de vent du Sud-Ouest. Compt. rend. acad. sc., Paris, xciii., séance du 8 août, 1881. 2 pp. la. 8°. [?]

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* || **Hopkins, —.**—On the origin and nature of the forces that produce storms. Read Dec. 16th, 1851. [*Mem. Lit. Phil. Soc. Manchester.*]

* || **Jouan, H.**—Quelques observations sur les typhons ressentis dans la mer de Chine pendant les mois d'Août, Septembre et Octobre, 1867. pp. 113–141, la. 8°. [?]

* **Julien, F.**—Courants et révolutions de l'atmosphère et de la mer, comprenant une théorie nouvelle sur les déluges périodiques. vi. + 240 pp. 8°. Paris, 1860.

Klossovsky, A.—Les orages au sud de la Russie. 41 pp., 4 plates, la. 8°. Odessa, 1886.

|| **(Lang, C.)**—Ueber mittlere Windgeschwindigkeit in Bayern mit besonderer Berücksichtigung der Verhältnisse Münchens. 4 pp. la. 4°. (*Beobacht. meteor. Stat. K. Bayern.* vii., 1885, *p.* 34.)

* || **[Lloyd, H.]**—Notes on the storm of the 18th of April [1850]. 6 pp. 8°. [*Proc. R. Irish Acad.*, iv., *p.* 515.]

Natal Harbour Board.—Diagram showing the direction and velocity of wind from 1st January to 31st December 1885. By **D. I. Nolan.** la. 4°. Sheet.

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|| **Prince, C. L.**—An analysis of forty years' consecutive observations of storms in the county of Sussex. 6 pp., 1 plate, la. 8°. (*Quart. Journ. R. Meteor. Soc.*, xiii., 1887, *p.* 79.)

|| **Ragona, D.**—Studi sulla frequenza dei venti, e sulle relazioni della medesima coi principali elementi meteorologici. 92 pp. sm. f°. Roma, 1886. (*Mem. Pontif. Acad. Nuovi. Lincei*, ii.)

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* **Alexandrow, A.**—Complete Russian-English dictionary. 2+1034+42 pp. 8°. (St. Petersburg), 1885.
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Baden-Powell, B. F. S.—How I learnt ballooning. 11 pp. 8°. (*Temple Bar*, 1887, *Mch.*, *p.* 424.)

* **Bert, P.**—First year of scientific knowledge. Translated by **J. Clayton.** Third edition. 344 pp. sm. 8°. London and Paris, 1886.

Board of Trade, Standards Office.—Equivalents of imperial and metric weights and measures. Imperial to metric. Metric to imperial. 2 cards, sm. 4°. London, 1886.

Boldva, A. B. v.—Jan Mayen, nach der Aufnahme der österreich. arct. Beobachtungsstation, 1882–83. 1 chart, la. f°. s.l.e.a.

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[**Cunningham, J. T.**]—The Scottish marine station for scientific research, Granton, Edinburgh, its work and prospects. 54 pp., 6 plates, 8°. Edinburgh, 1885.

|| **Davison, C., and Love, E. F. J.**—On the need of combined action for the translation and publication of foreign scientific memoirs. Read before the Soc., May 13th, 1886. 4 pp. 8°. (*Proc. Birmingham Phil. Soc.*, v., *part* i.)

[**Editorial Committee of the Norwegian North Atlantic Expedition.**—Den Norske Nordhavs-Expedition, 1876–1878. xv. Zoologi. Crustacea, II. ved **G. O. Sars.** 96 pp., 1 plate, f°. Christiania, 1886.
In the English language also.

———.—Den Norske Nordhavs-Expedition, 1876–78. xvi. Zoologi. Mollusca, II., ved **H. Friele.** 44 pp., 6 plates, f°. Christiania, 1886.
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* || **Forbes, [J. D.]**—Researches on heat. Third series. 4 pp. 8°. (*Proc. R. Soc. Edinb.*, 1838, *Apl.* 16.)

|| **Frankland, P. F.**—The distribution of micro-organisms in air. 18 pp. 8°. (*Proc. R. Soc.* xl., 1886, *p.* 509.)

* **Greely, A. W.**—Three years of Arctic service. An account of the Lady Franklin Bay expedition of 1881–84, and the attainment of the farthest North. 2 vols., with maps plates, and portraits, la. 8°. London, 1886.

Hector, J.—Handbook of New Zealand. Fourth edition, revised. 120 pp., 7 plates, la. 8°. Wellington, 1886.

* || **Hopkins, —.**—On the causes of the great currents of the ocean. Read 4th Nov. 1851. 15 pp. 8°. (*Mem. Lit. Phil. Soc. Manchester.*)

Hydrographisches Amt der Admiralität, Berlin.—Die Ergebnisse der Untersuchungsfahrten S. M. Knbt. "Drache" (Kommandant Korvetten-Kapitän Holzhauer) in der Nordsee in den Sommern 1881, 1882 und 1884. iv.+77 pp., 15, plates, 4°. Berlin, 1886.

Inspector General of Customs, Shanghai.—List of the Chinese lighthouses, light-vessels, buoys, and beacons for 1886. (Corrected to 1st December 1885.) 14th Issue. 44 pp., 5 plates, 4°. Shanghai, 1886.

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Nederlandsche Pool-Expeditie 1882-83, De,—Beschreven door Dr. **M. Snellen,** uitgegeven door de zorg van den Luitnt. ter Zee 1ste Klasse **B. J. G. Volck.**—xii. + 164 pp., 20 plates, 3 portraits, f°. Utrecht, 1886.

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|| **Prestwich, J.**—On the agency of water in volcanic erruptions; with some observations on the thickness of the earth's crust from a geological point of view; and on the primary cause of volcanic action. Read, April 16, 1885. 57 pp., 1 plate, 8°. London, 1886. (*Proc. R. Soc.*, 1886, *No.* 246, *p.* 117.)

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* **Richthofen, F. F. von.**—Führer für Forschungsreisende. Anleitung zu Beobachtungen über Gegenstände der physischen Geographie und Geologie. xii. + 745 pp. 8°. Berlin, 1886.

* **Shaw, G. A.**—Madagascar of to-day. An account of the Island, its people, resources and development. 190 pp., 1 plate, 18°. London, 1886.

* **"The Times"** register of events in 1886. clxxxviii. + 216 pp. 8°. London, 1887.

Vogel, J.—The official handbook of New Zealand. A collection of papers by experienced colonists on the colony as a whole, and on the several provinces. 272 pp., 31 plates, 8°. London, 1875.

Wall, H. B. de la P.—Manual of physical geography of Australia. viii. + 194 pp., 5 plates, sm. 8°. Melbourne, 1883.

Walsingham, Lord.—On some probable causes of a tendency to melanic variation in lepidoptera of high latitudes. Being the annual address of the President to the Members of the Yorkshire Naturalists' Union, at Doncaster, March 3rd, 1885. 28 pp. 8°. (Leeds, s.a.)

APPENDIX XVI.

METEOROLOGICAL OFFICE: ACCOUNT of RECEIPTS and PAYMENTS for the year ending 31st March 1887.

RECEIPTS.

	£ s. d.	£ s. d.
Balance from year 1885–86		2,265 0 8
Parliamentary Vote		15,300 0 0
Repayment of expenses charged under—		
(1.) Incidental expenses	25 4 9	
(2.) Special researches	23 15 8	
(3.) Observatories and stations	0 8 11	
		49 9 4
SUPPLY OF INFORMATION:		
D.W. Charts and Forecasts	232 0 2	
6 p.m. Charts	22 18 4	
Information for Press Agencies, &c.	76 15 8	
Telegrams	322 13 4	
Miscellaneous data	12 1 6	
		666 9 0
SALE OF INSTRUMENTS, &c.:		
Royal Navy (A)	4 0 0	
Mercantile Marine account (B)	39 2 5	
		43 2 5
Commissions executed for Colonial and Foreign Institutions, &c. (C)		221 3 3
Commission charged on work done for Colonies, &c.		23 13 11
		£18,568 18 7

PAYMENTS.

	£ s. d.	£ s. d.
ADMINISTRATION:		
Payment of Council	1,000 0 0	
Secretary	800 0 0	
Salaries and wages	792 12 0	
Rent, fuel, and lighting	710 0 7	
Incidental and contingent expenses:—		
Attendance, cleaning, &c.	416 17 11	
Furniture and fittings	232 15 1	
Expenses incidental to International Meteorological Congress	11 0 0	
Pensions	42 16 4	
		4,006 1 11
SPECIAL RESEARCHES		493 8 3
LAND METEOROLOGY:		
Observatories and stations	1,870 11 6	
Salaries:— Discussion and reduction of observations	1,291 1 4	
		3,161 12 10
WEATHER INFORMATION AND FORECASTS:		
Telegraphic reports and storm warnings	3,083 5 11	
Salaries:— Preparation and issue of reports and forecasts	1,639 19 9	
		4,723 5 8
INSPECTIONS:		
Salaries and travelling expenses		559 16 9
OCEAN METEOROLOGY:		
Salaries:—Discussion and reduction of observations	1,858 11 0	
Expenses incidental to the supply of instruments:—		
Proportion for care and issue of instruments	200 0 0	
Royal Navy	429 14 10	
Mercantile Marine	437 7 6	
Distant island and coast stations	22 8 5	
		2,948 1 9
Commissions executed for Colonial and Foreign Institutions, &c.		294 2 8
BALANCE:		
Cash at Bank	2,249 8 11	
„ at Office	82 19 11	
Advance to Valencia Observatory	50 0 0	
		2,382 8 9
		£18,568 18 7

APPENDIX XVII.

LIST OF PUBLICATIONS, &c. issued under the Authority of the Meteorological Council.

OFFICIAL.

No. 1. Report for 1867. Presented to Parliament. 1*s.*
2. Instructions for Meteorological Telegraphy. New Edition. (1875.) 6*d.*
3. Fishery Barometer Manual. 6*d.* (New edition, 1887.)
4. Charts of Surface Temperature, South Atlantic Ocean. 2*s.* 6*d.*
5. Report for 1868. Presented to Parliament. 5*d.*
6. Report for 1869. Presented to Parliament. 10*d.*
7. Quarterly Weather Report for 1869.—Parts I. to IV. 5*s.* each.
8. Barometer Manual. (Out of print, see Nos. 3, 24, 40, 60, and 61.)
9. Quarterly Weather Report for 1870.—Parts I. to IV. 5*s.* each.
10. Report for 1870. Presented to Parliament. 10*d.*
*11. Contributions to our Knowledge of the Meteorology of Cape Horn and the West Coast of South America. 2*s.* 6*d.*
*12. Currents and Surface Temperature of the North Atlantic Ocean, from the Equator to Lat. 40° N., for each month of the year, with a General Current Chart. 2*s.* 6*d.*
13. A Discussion of the Meteorology of the Part of the Atlantic lying North of 30° N., for the Eleven Days ending 8th February 1870. Price, with Book of Charts, 5*s.*
14. Quarterly Weather Report for 1871.—Parts I. to IV. 5*s.* each.
15. Report for 1871. Presented to Parliament. 10*d.*
16. Quarterly Weather Report for 1872.—Parts I. to IV. 5*s.* each.
17. Report for 1872. Presented to Parliament. 1*s.*
18. Contributions to our Knowledge of the Meteorology of the Antarctic Regions. 2*s.*
19. Quarterly Weather Report, 1873.—Parts I. to IV. 5*s.* each.
20. Charts of Meteorological Data for Square 3. Lat. 0°—10° N. Long. 20° — 30° W., and Remarks to accompany the Monthly Charts, which show the Best Routes across the Equator for each Month, &c. 20*s.*
21. Report of the Proceedings of the Meteorological Congress at Vienna. 1*s.*
22. Report for 1873. Presented to Parliament. 4*d.*
23. Report of the Proceedings of the Conference on Maritime Meteorology held in London, 1874. 2*s.*
24. Instructions in the Use of Meteorological Instruments. [Reprinted 1885.] 6*s.*
25. Quarterly Weather Report for 1874.—Parts I., II., and IV. 5*s.* each. Part III., 5*s.* 9*d.*
26. Report for 1874. Presented to Parliament. 6*d.*

* The Meteorological Council have given away the copies which were placed at their disposal, but they can be purchased from the Publishers.

LIST OF PUBLICATIONS, &c.—*continued.*

No. 27. Charts of Meteorological Data for the Nine 10° Squares of the Atlantic which lie between 20° N. and 10° S., and extend from 10° to 40° W., with accompanying Remarks, ending with the Best Routes across the Equator. 24*s.*

28. Contributions to our Knowledge of the Meteorology of Japan. By Staff-Commander Thomas H. Tizard, H.M.S. *Challenger.* 1*s.*

29. Report for 1875. Presented to Parliament. 4*d.*

30. Quarterly Weather Report for 1875.—Parts I.—IV. 5*s.* each.

31. Report for 1876–7. Presented to Parliament. 3*s.* 5*d.*

32. A Discussion of the Meteorology of the North Atlantic during August 1873, with 31 Synoptic Charts. 15*s.*

33. Quarterly Weather Report for 1876 (New Series).—Part I., 6*s.*; Parts II., III., and IV., 5*s.* each.

*34. Contributions to our Knowledge of the Meteorology of the Arctic Regions. Vol. I.,—Part I., 2*s.*; Part II., 10*s.*; Part III., 6*s.*; Part IV., 5*s.*

35. Report for 1877–8. Presented to Parliament. 1*s.*

36. Report of the Proceedings of the Meteorological Congress at Rome, 1879. 1*s.* 6*d.*

37. Report on the Meteorology of Kerguelen Island. By the Rev. S. J. Perry, S.J., F.R.S. 3*s.*

38. Report for 1878–9. Presented to Parliament. 5*d.*

39. Meteorological Observations at Stations of the Second Order for the year 1878. 20*s.*

40. Aids to the Study and Forecast of Weather, by the Rev. W. Clement Ley, M.A. 1*s.*

41. Report for 1879–80. Presented to Parliament. 1*s.*

42. Report for 1880–81. Presented to Parliament. 1*s.* 2*d.*

43. Charts of Meteorological Data for the Ocean District adjacent to the Cape of Good Hope, with accompanying Remarks. Price of the Charts, 25*s.*: of the Remarks, 7*s.*

44. Report on the Gales experienced in the Ocean District adjacent to the Cape of Good Hope, between Lat. 30° and 50° S., and Long. 10° and 40° E., by Capt. H. Toynbee, F.R.A.S. 7*s.* 6*d.*

45 Meteorological Observations at Stations of the Second Order for the year 1879. 20*s.*

46. Report on the Storm of October 13–14, 1881. By Robert H. Scott, F.R.S. 1*s.* 6*d.*

47. Rainfall Tables of the British Isles for 1866–80. Compiled by G. J. Symons, F.R.S. 7*s.* 6*d.*

48. Report for 1881–2. Presented to Parliament. 1*s.*

49. Quarterly Weather Report for 1879. (New Series.) Appendices and Plates. 27*s.* Parts I. and II., 6*s.* each. (Part III., in the Press.)

50. Quarterly Weather Report for 1880. (New Series.) Appendices and Plates. 28*s.*

51. Hourly Readings, 1881. (New Series.) Part I., 10*s.* 6*d.* Parts II., III., and IV., 21*s.* each.

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* The Meteorological Council have given away the copies which were placed at their disposal, but they can be purchased from the Publishers.

LIST OF PUBLICATIONS, &c.—*continued.*

No. 52. Quarterly Weather Report for 1877. (New Series.) Appendices and Plates. 27*s.*; Part I., 10*s.*; Part II., 5*s.*; Part III., 4*s.* 6*d.*; Part IV., 6*s.*

53. Meteorological Atlas of the British Isles. 5*s.* 6*d.*

54. Hourly Readings, 1882. Parts I. and II., 20*s.* each, Part III., 22*s.* 6*d.* Part IV., 26*s.*

55. Quarterly Weather Report for 1878. (New Series.) Appendices and Plates. 28*s.*; Parts I., II., III., and IV., 6*s.* each.

56. Sunshine Records of the United Kingdom for 1881. 4*s.*

57. Meteorological Observations at Stations of the Second Order for the year 1880. 34*s.* 6*d.*

58. Report for 1882–3. Presented to Parliament. 10½*d.*

59. Sea Temperature Charts for the Atlantic, Pacific, and Indian Oceans. 21*s.*

60. Principles of Weather Forecasting. By the Hon. Ralph Abercromby, F.R.Met.Soc. (Second edition, revised), 2*s.*

61. The Barometer Manual for the Use of Seamen. 1*s.* 3*d.*

62. Monthly Weather Report, 1884. Jan., Feb., March, May—Nov., 1*s.* 6*d.* each. April (with 2 Appendices), 2*s.* 6*d.* Dec., 1*s.* 9*d.*

63. Hourly Readings, 1883. Parts I., II., and III., 21*s.* each. Part IV., 30*s.*

64. Report for 1883–4. Presented to Parliament. 1*s.* 2*d.*

65. Monthly Weather Report, 1885. Jan. to Dec. 1*s.* 6*d.* each.

66. Meteorological Observations at Stations of the Second Order for 1881. 35*s.*

67. Report for 1884–5. Presented to Parliament. 4*s.* 4*d.*

68. Monthly Weather Reports for 1886. Jan.—Dec., 1*s.* 6*d.* each.

69. Meteorological Observations at Stations of the Second Order for the year 1882. 35*s.*

70. Hourly Readings, 1884. Part I., 12*s.*; Part II., 10*s.*; Part III., 10*s.* 6*d.* Part IV., 15*s.*

71. Synchronous Weather Charts of the North Atlantic and the adjacent Continents. Aug. 1, 1882 to Aug. 31, 1883. Parts I., II., and III. 17*s.* each. (Part IV., in the Press.)

72. Report for 1885–86. Presented to Parliament. 8*d.*

73. Meteorological Observations at Stations of the Second Order for the year 1883. 30*s.*

74. Hourly Readings, 1885. Parts I. and II., 11*s.* each. (Part III., in the Press.)

75. Report for 1886–87. Presented to Parliament. 8*d.*

76. Charts showing the Mean Barometric Pressure over the Atlantic, Indian, and Pacific Oceans, 10*s.* 6*d.*

77. Monthly Weather Reports for 1887. January and February, 1*s.* 6*d.* each. (March, in the Press.)

78. Meteorological Observations at Stations of the Second Order for the year 1884. (In the Press.)

LIST OF PUBLICATIONS, &c.—*continued.*

NON-OFFICIAL.

No. 1. Report to the Committee on the Connexion between Strong Winds and Barometrical Differences.—By Robert H. Scott, Director of the Office. 6*d.*

*2. Report to the Committee on the Meteorology of the North Atlantic.—By Captain H. Toynbee, Marine Superintendent 1*s.*

*3. Report to the Committee on the Use of Isobaric Curves.—By Captain H. Toynbee, Marine Superintendent. 1*s.*

4. Routes for Steamers from Aden to the Straits of Sunda and back. Translated from a Paper issued by the Royal Meteorological Institute of the Netherlands. 6*d.*

5. On the Winds, &c. of the North Atlantic along the Tracks of Steamers from the Channel to New York. Translated from a Paper issued by the Deutsche Seewarte, Hamburg. 6*d.*

6. Report of the Proceedings of the Meteorological Conference at Leipzig. 1*s.*

7. Notes on the Form of Cyclones in the Southern Indian Ocean.—By C. Meldrum, M.A., F.R.S. 6*d.*

8. Report on Weather Telegraphy and Storm Warnings. Presented to the Meteorological Congress at Vienna. 6*d.*

9. Report of the Permanent Committee of the Vienna Congress for 1874. 1*s.* 6*d.*

10. On the Physical Geography of that part of the Atlantic which lies between 20° N. and 10° S. and extends from 10° to 40° W. A Paper read before the British Association at Bristol, in August 1875.—By Capt. Toynbee, F.R.A.S., F.R.G.S., Marine Superintendent. 1*s.* 6*d.*

11. Report of the Permanent Committee of the Vienna Congress for 1876. 2*s.*

12. Reports to the Permanent Committee of the Vienna Congress on Atmospheric Electricity, Maritime Meteorology, and Weather Telegraphy, 1878. 2*s.*

13. Report of the Permanent Committee of the Vienna Congress for 1878. 6*d.*

14. Report of the International Meteorological Committee Meeting at Berne, 1880. 1*s.*

15. Report of the Second Meeting of the International Meteorological Committee, held at Copenhagen, August 1882. 2*s.* 6*d.*

16. Report of the Third Meeting of the International Meteorological Committee, held at Paris, September 1885. 1*s.*

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* The Meteorological Council have given away the copies which were placed at their disposal, but copies can be purchased from the Publishers.

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LONDON: Printed by EYRE and SPOTTISWOODE,
Printers to the Queen's most Excellent Majesty.
For Her Majesty's Stationery Office.

REPORT

OF THE

METEOROLOGICAL COUNCIL

TO THE

ROYAL SOCIETY,

For the Year ending 31st of March 1887.

Presented to both Houses of Parliament by Command of Her Majesty.

LONDON:
PRINTED FOR HER MAJESTY'S STATIONERY OFFICE,
BY EYRE AND SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.

And to be purchased, either directly or through any Bookseller, from
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1888.

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THE METEOROLOGICAL COUNCIL,

1887–88.

Lieutenant-General RICHARD STRACHEY, R.E., C.S.I., F.R.S., Chairman.

MR. ALEXANDER BUCHAN, LL.D., F.R.S.E. (appointed December 24, 1887).

Professor GEORGE HOWARD DARWIN, M.A., LL.D., F.R.S.

MR. FRANCIS GALTON, M.A., F.R.S.

Professor GEORGE GABRIEL STOKES, LL.D., P.R.S. (resigned November 7, 1887).

MR. EDWARD J. STONE, M.A., F.R.S.

Captain WILLIAM J. L. WHARTON, R.N., F.R.S., Hydrographer of the Admiralty.

REPORT

OF THE

METEOROLOGICAL COUNCIL

TO THE

ROYAL SOCIETY,

For the Year ending March 31, 1888.

Introductory.

THE COUNCIL has to record the resignation by Professor Stokes, President of the Royal Society, of his seat, which he has held since the formation of the Council in 1877; and in so doing they desire to express the sense they entertain of the high value of his services, and their regret that circumstances should have deprived them of a colleague so eminently qualified to aid them with his advice, and to give weight to the results of their deliberations. The vacancy thus caused has been filled by the appointment of Mr. Alexander Buchan, LL.D., F.R.S.E., Secretary to the Scottish Meteorological Society. The executive officers continue as before:—

Mr. R. H. Scott, M.A., F.R.S., Secretary.
Captain H. Toynbee, F.R.A.S., Marine Superintendent.
Navigating-Lieutenant C. W. Baillie, F.R.A.S., Assistant do.

The present Report is as usual arranged under three headings:—

I. Ocean Meteorology.
II. Weather Telegraphy.
III. Land Meteorology of the British Isles.

PART I.

OCEAN METEOROLOGY.

Collection of information.

Collection of Information.—The practice followed by the Office as regards its dealing with observers at sea has not been changed, and is described in former Reports.

Recognition of "excellent" observers

Appendix I. (p. 41) contains a list of all the observers who have contributed "excellent" logs during the past year. Some of them have regularly co-operated with the Office for many years; the names which now appear in the list for the first time are as follows:—

Captain's Name.	Ship.
Ashdown, Edward	S.S. "Brindisi."
Cameron, H.	S.S. "Ardandhu."
Cameron, J. G.	S.S. "Adriatic."
Cromarty, D. S.	"Cassandra."

Captain's Name.	Ship.
Dark, Samuel	"Blairgowrie."
Donaldson, J.	"Gareloch."
Ewan, John	S.S. "Kenmore."
Exham, T. K.	S.S. "Severn."
Hood, William	"County of Edinburgh."
Janes, George	"Middlesex."
Jones, Richard	"Thomas Hilyard."
Kempe, A. H.	"Hudson."
Millican, J. W.	"Myrtle Holme."
Milner, W. H.	S.S. "Severn" and S.S. "Solent."
Mitchell, John	"Cape Verde."
Read, G. W., F.R.G.S.	S.S. "Auretta."
Richardson, Mr. W. H.	Do.
Ross, James	S.S. "Ben Alder."
Tancred, Sub.-Lieut. J. C., R.N.	H.M.S. "Egeria."

The Council regret to record the death of Captains George Denham, John Peach Holdich, R.N.R., and R. S. Tannock, who were "excellent" observers.

Proportion of "excellent" to total number of logs received.

The following is the total number of logs received from April 1, 1887, to March 31, 1888, and the number of logs which have been classed as "excellent":—

Total No. of Logs received.	No. of Excellent Logs.	Per-centage of Excellent Logs.
182	128	70

The average number of logs received annually during the five years, 1882–86, was 175, and the per-centage of excellent logs among these was 73.

The Council take this opportunity of expressing their best thanks to the observers who have assisted them during the past year.

Districts from which observations are obtained.

On the 31st of March 1888 the ships observing for the Office were pursuing the following voyages:—

To Baffin's Bay or Greenland	4
„ North America, East Coast	15
„ „ „ West „	8
Off East Coast of North America	3
To South America, East Coast	10
„ „ „ West „	5
„ Australia and New Zealand, viâ Cape of Good Hope	33
„ „ „ „ Suez	4
„ India, viâ Suez	8
„ India, viâ Cape of Good Hope	24
„ China Seas, viâ Suez	7
„ West Coast of Africa	1
„ Cape of Good Hope	2
„ West Indies	10
Between British Ports	6
Unknown	5
Total number of ships	145

Appendix II. (p. 44) supplies a list of the logs and of all the documents from stations abroad received at the Office during the year.

Resignation of Captain Toynbee.

Contemplated Resignation of Captain Toynbee.—The Council have to announce, with great regret, that Captain Toynbee has intimated to them his wish to retire from the Office at the end of June 1888. He has discharged the duties of Marine Superintendent for a period of over 21 years, and the Council desire to record their high sense of the intelligence and untiring devotion he has exhibited in the discharge of his duties. They contemplate the appointment of Mr. Baillie to the post to be vacated by Captain Toynbee.

Synchronous weather charts.

North Atlantic Weather Charts.—The investigation of the weather over the North Atlantic Ocean for the 13 months, beginning August 1st, 1882, and ending August 31st, 1883, the period during which the International System of Circumpolar Observations was carried out, has employed nearly the whole Marine Branch of the Office during the interval covered by this Report. The work is now completed.

An additional sheet has been given for September 1st to 3rd, 1883, to show more satisfactorily the progress of an important cyclonic system which originated near 20° N., 55° W., on the 21st August, and gradually developed into the severe cyclone which crossed the British Islands on September 1st to 3rd. It passed north of Norway after the 6th.

The method adopted for carrying out the investigation, with specimen charts, will be found at pp. 8–10 of the Report for 1883. A note, drawn up by the Secretary, stating some results of a consideration of these charts with respect to the light thrown by them on the probable utility of telegraphy of storms from America, will be found at Note A., p. 22.

Meteorology of the Red Sea.

Red Sea Charts.—The discussion of the Meteorology of the Red Sea, based on information obtained from the Admiralty, the Royal Meteorological Institute of the Netherlands, and the Peninsular and Oriental Steamship Company, as well as from logs obtained from other sources, has been continued on the system explained in last year's Report.

The tracks of steamers through the Red Sea are confined to such a narrow strip that it was thought best to represent the barometrical and thermometrical data by projections along lines indicating the course down the axis of the sea, while the winds are shown in "roses" along the average track, and the currents in their observed position.

Barometrical pressure charts.

The Charts of Barometrical Pressure for the Atlantic, Pacific, and Indian Oceans for the months of February, May, August, and November are in the publisher's hands. A chart showing the mean barometrical pressure for the year has also been prepared for the same oceans, and will soon be published.

Foreign stations.

Supply of Instruments to Foreign Stations.—On the recommendation of the Hydrographer instruments have been supplied on loan to the Spanish National and West African Coast Cable Co., for use at their stations at Teneriffe, Bathurst, Grand Bassin, Saint Thomas, and the Gaboon River.

Instruments have also been supplied to Watling Island, an additional lighthouse station in the Bahamas.

A rain gauge has been supplied to Mr. Ford, a resident on Valua Island, in the Banks Group, near the New Hebrides.

Current charts.

Current Charts for the Atlantic, Pacific, and Indian Oceans.—Considerable progress has been made during the past year in the construction of these charts, and the staff employed on them having been gradually increased, as the North Atlantic Weather Charts were finished, they will proceed more rapidly in future.

The charts representing the winds, currents, temperature of the sea, &c., off Cape Guardafui during the South-west Monsoon, which have been constructed with the object of assisting seamen when rounding that Cape, in the vicinity of which casualties are frequent, have had valuable additions made to them, and it is hoped that they will soon be ready for publication.

Charts of the Aden cyclone, 1885.

The Aden Cyclone of June 1885.—At the suggestion of Dr. Meldrum, of the Mauritius, the Council have collected, from all available sources, information as to the weather over the North Indian Ocean in the months of May and June 1885. 233 logs having been received, synchronous daily charts of that ocean have been prepared for the space of about six weeks with the view of throwing some light on the history of this storm, particularly as regards its unusual course over the Arabian Sea and Gulf of Aden.

Indian Ocean cyclone tracks.

Cyclone Tracks in the Southern Indian Ocean.—Monthly charts are being prepared to show the seasonal distribution of cyclones in the Southern Indian Ocean for the years 1848–1886. The material for these charts has been received from Dr. Meldrum, of Mauritius, who, in concert with the local Meteorological Society, has long been engaged in the study of these storms, a knowledge of the occurrence of which is of great practical interest to the inhabitants of the island, and to navigators on the South Indian Ocean. As this information is highly important to seamen, the Council have resolved to aid in its publication.

Charts to accompany meteorological logs.

Charts for Meteorological Logs.—It is intended by the Council, to issue in future, with the "Instructions for Keeping the Meteorological Log," which are supplied to intending observers at sea, who make use of the form of log prepared by the Office, a copy of each of the four small quarterly index charts of surface temperature, and of barometrical pressure over the ocean, which have been published by the Office. These charts will be accompanied by a copy of the latest Admiralty chart of Magnetic Variation. The information thus supplied cannot fail to be useful

to captains of ships, and likely to assist them in the careful record of the meteorological data which they enter in their logs.

Arctic meteorology.

Contributions to our Knowledge of the Meteorology of the Arctic Regions.—Part V. of this work is now in the press. It deals with documents relating to the following wintering stations situated in the neighbourhood of Behring Straits:—

Wintering Station.	Ships.	Commanders.	Years.	Information already published.
Port Providence	H.M.S. Plover	T. E. L. Moore	1848–9	Nothing published.
Chamisso Island	,,	,,	1849–50	,, ,,
Port Clarence -	,,	,,	1850–1	,, ,,
,, -	,,	,,	1851–2	,, ,,
,,	H.M.S. Rattlesnake.	H. Trollope -	1853–4	,, ,,
Point Barrow -	H.M.S. Plover	R. Maguire -	1852–4	Temperature by Dr. Simpson, R.N.

The future Marine Work of the Office.—It is contemplated, as soon as the Red Sea work is completed, to take up the discussion of the weather, in the manner adopted for parts of the Atlantic, for the region lying between the Cape of Good Hope and New Zealand, the outward track of the Australasian trade.

Instruments belonging to the Office.

Supply and Stock of Instruments.—In Appendix III. (p. 61) will be found a list of the meteorological instruments supplied by the Office to ships in the Royal Navy during the year, with a statement of the entire stock and distribution of instruments standing on the books, to the account of the Admiralty, on the 31st March 1888.

Appendix IV. (p. 62) gives similar information with regard to the disposal of the other instruments belonging to the Office, which are mainly supplied to the Mercantile Marine.

PART II.

Weather Telegraphy.

Administrative.

The service has been generally conducted as in previous years. In the middle of March the telegraphic communication between Stornoway and the mainland broke down, and had not been restored at the date of this Report.*

The following have been the only changes worth notice in the reporting staff during the year. At Prawle Point Mr. Hewitt has been appointed officer of the coast-guard station, and has taken over the duty of reporting from Mr. John. At Parsonstown and Pembroke (St. Anne's Head) there have been slight changes.†

* Communication was restored on April 13th.

† The Council have to regret the loss by death, early in the month of April, of Mr. J. M'Cormack, who had been for many years their meteorological reporter at Aberdeen.

Administrative. A list of the telegraphic reporters will be found in Appendix V. (p. 63), and a Map of all the stations is appended to Note D., p. 33.

The work in this branch of the Office continues to increase. The addition of the new foreign reports (as mentioned in the Report for 1886, App. VII.) to the other information received daily by telegraph, and the daily entry on special charts of the information received by telegraph from the United States, entail a material increase in routine work, such as correction of the ordinary errors of reporting and transmission, and there has besides been a steady increase in the amount of information conveyed by the Daily and Weekly Weather Reports. The time required for this must be taken from the scanty margin available for scientific investigation. The death in the month of September of Mr. H. J. Stevens, the telegraphist, has also seriously delayed the work.

Inspection of the stations. *Inspection of the Telegraphic Reporting Stations.*—The telegraphic reporting stations have been inspected during the year, in England (including Jersey) by the Rev. W. Clement Ley; in Scotland by Mr. Buchan; and in Ireland and Wales by Mr. Scott. The reports submitted by the Inspectors to the Council, which are printed in Appendix VI. (p. 64), show that the efficiency of the service has been maintained.

Discussion of the reports. *Discussion and Publication of the Information received.*—An account of the practice of the Office in the collection, discussion, and dissemination of the meteorological information received by telegraph is given in Appendix VII. (p. 81), and a list of the institutions and persons who received the Daily Weather Reports and Charts free of cost in 1887–8 in Appendix VIII. (p. 92).

Forecasts. *Weather Forecasts.*—There has been no material change in the system of preparation and issue of the forecasts during the year.

Forecasts are prepared three times a day, at 11h. a.m., at 3h. 30m., and 8h. 30m. p.m. The Forecasts prepared at 11 a.m., on the information derived from the 8 a.m. reports, refer to the probable weather between noon on the day of issue and noon on the following day; they are publicly posted up in several places in London,* and supplied for the afternoon editions of the newspapers. The forecasts prepared at 8h. 30m. p.m. are intended primarily for the newspapers, but any of the forecasts are available for the information of persons requiring them.

Inquiries at the Office. The inquiries received through the Post Office for special forecasts during the year amounted to 63, and the personal applications to 71. The rules of the Office relating to such inquiries

* Viz., in the City, at the Mansion House, Lloyd's Rooms, Messrs. R. & J. Beck's, Cornhill, and Messrs. Thos. de la Rue & Co.'s, Bunhill Row; in the West End, in the Libraries of the House of Lords and House of Commons; at Messrs. Elliot's, St. Martin's Lane; Messrs. Stanford's, Charing Cross; Messrs. Negretti & Zambra's, Regent Street; and Messrs. Pastorelli's, New Bond Street.

continue the same as in previous years. See Appendix VII. (p. 81).

The results of a comparison of the Forecasts issued at 8 p.m. during the year with the weather actually experienced are given in Appendix XI. (p. 98). The following summary of successes and failures, estimated as explained in that Appendix, shows that the average of success over the whole United Kingdom has been 84 per cent., 3 per cent. more than for the previous year. Testing of the forecasts.

SUMMARY OF RESULTS of 8.30 p.m. FORECASTS, 1887.

Districts.	Percentages.				Total percentage of Success.
	Complete Success.	Partial* Success.	Partial* Failure.	Total Failure.	
SCOTLAND, N. - -	52	33	10	5	85
„ E. - -	51	32	11	6	83
ENGLAND, N.E. - -	57	30	8	5	87
„ E. - -	54	32	9	5	86
MIDLAND COUNTIES -	53	32	11	4	85
ENGLAND, S. - -	56	30	10	4	86
SCOTLAND, W. - -	46	34	12	8	80
ENGLAND, N.W. -	55	27	11	7	82
„ S.W. -	57	28	8	7	85
IRELAND, N. - -	49	31	12	8	80
„ S. - -	50	30	11	9	80
Summary - -	53	31	10	6	84

* Note "partial" implies "more than half."

Hay Harvest Forecasts.—The Council renewed in 1887 the offer made in previous years to the Royal Agricultural Society, the Royal Dublin Society, and the Highland and Agricultural Society to send daily Forecasts *gratis* during the haymaking season to a number of observers selected by those Societies, on the two conditions, that the information should be made known as widely as possible, and that a record should be kept of the weather actually experienced and be sent weekly to the Office. The Societies again cordially accepted the proposal, and the following list of recipients was prepared:— Hay Harvest Forecasts.

Hay Harvest Forecasts.

List of those who received Hay Harvest Forecasts in 1887.

Districts.	To whom sent.	Address.
0. Scotland, N.	Rev. Dr. Joass	Golspie.
	Major Smith	Munlochy, Inverness.
1. Scotland, E.	G. Johnstone	Glamis, by Forfar.
	W. W. Kerr	Ferrygate, North Berwick.
	A. F. Leslie	Braco, Keith.
	C. L. W. Forbes	Aberfeldy.
2. England, N.E.	J. Wilson	Chillingham Barns, Chatton, Northumberland.
	J. Turner	The Grange, Ulceby.
3. England, E.	W. Birkbeck	High House, Thorpe, Norwich.
	Sir J. B. Lawes, Bt., and J. H. Gilbert, Ph.D.	Rothamsted, Harpenden.
4. Midland Counties	Royal Agricultural College.	Cirencester.
	E. E. Harcourt-Vernon	Grove Hall, East Retford.
5. England, S.	C. Whitehead	Barming House, Maidstone.
	E. P. Squarey	The Moot, Downton, Wilts.
	G. M. Allender	Stammerham, Horsham.
6. Scotland, W.	W. Calder	Castle Hill, Dalreoch, Dumbarton.
	M. J. Stewart, M.P.	Ardwell, Stranraer.
	J. S. R. Ballingal	Eallabus House, Islay.
7. England, N.W.	G. W. Wray	Leyburn, Yorkshire.
	The Earl of Derby, K.G.	Knowsley Hall, Prescot.
	F. W. Earle, Esq.	Edenhurst, Roby, Liverpool.
8. England, S.W.	Colonel J. B. Turbervill	Ewenny Priory, Bridgend, Glamorganshire.
	The Earl of Ducie	Spring Park, Gloucestershire.
	T. Dyke	Long Ashton, Clifton, Bristol.
9. Ireland, N.	Rev. A. Brown	The Manse, Hollymount, Co. Mayo.
	E. F. Farrell	Moynalty, Co. Meath.
10. Ireland, S.	D. A. M'Cready	Larchvale, Moneygall, King's Co.
	D. A. Milward	Lavistown, Kilkenny.
	W. Talbot Crosbie, D.L.	Ardfert Abbey, Tralee, Co. Kerry.

The issue of the forecasts commenced (June 13th) with those for England, E., the Midland counties, and England, S., and later those for the other districts were added. The forecasts were issued daily (excepting on Sundays), and in most instances they were continued for about five weeks.

The general result of the issue of these forecasts is shown by the subjoined table, which has been compiled solely from the

reports of the above-mentioned gentlemen, and is entirely independent of any estimate formed within the Office itself:— Hay Harvest Forecasts.

SUMMARY of RESULTS.—HAY HARVEST FORECASTS, 1887.

Districts.	Names of Stations.	Percentages.				Total percentage of Success.
		Complete Success.	Partial Success.	Partial Failure.	Total Failure.	
SCOTLAND, N.	Golspie and Munlochy	54	38	8	—	92
„ E.	North Berwick, Glamis, Aberfeldy, and Braco.	49	26	2	23	75
ENGLAND, N.E.	Chatton and Ulceby	45	39	13	3	84
„ E.	Thorpe and Rothamsted	71	22	3	4	93
MIDLAND COUNTIES	Cirencester and East Retford	50	30	12	8	80
ENGLAND, S.	Horsham, Maidstone, and Downton	66	31	3	—	97
SCOTLAND, W.	Dumbarton, Islay, and Stranraer	61	33	6	—	94
ENGLAND, N.W.	Leyburn, Prescot, and Liverpool	56	35	6	3	91
„ S.W.	Bridgend (Glamorgan), Clifton and Spring Park (Gloucestershire).	55	37	8	—	92
IRELAND, N.	Moynalty, and Hollymount	52	34	14	—	86
„ S.	Moneygall, Kilkenny, Ardfert Abbey	58	33	9	—	91
	Mean for all districts, 1887	56	33	8	4	88
	„ „ 1886	53	31	13	3	84

The result of this year's checking shows that the general per-centage was 4 per cent. higher than in the preceding year. The largest general per-centage (97) was reached in England, S., while the smallest (75) was in Scotland, E.

In addition to the gentlemen who acted as recipients of these forecasts in 1887, and whose names are given on page 12, nine large landowners residing in different parts of the country applied for receipt of the forecasts at their own expense.

Independent testimony as to the correctness of the forecasts during the summer of 1887, and as to their value to, and appreciation by, the agricultural community was borne by Major Smith (Invernesshire), Mr. Boothby (Derbyshire), Mr. Fergusson (Suffolk), Sir J. Shelley (Devonshire), and Mr. Turner (Lincolnshire).

Storm Warnings for the Coasts of the United Kingdom.—In Appendix X. (p. 96) will be found the names of the stations which are furnished with signals for Storm Warnings, in accordance with Circular 717 of the Board of Trade issued in February 1874. Storm warnings.

Storm warnings.

These stations were, at the end of March 1888, 146 in number situated :—

70 in England, 14 in Wales, 41 in Scotland, 15 in Ireland, 3 in the Isle of Man, and 3 in the Channel Islands.

The usual comparison has been instituted in the Office between the warnings issued in 1887 and the weather experienced on our coasts, the warnings being tested by the method explained in Appendix VII. (p. 91). The results of the comparison are shown in the following tables:—

RETURN of the Result of the Comparison between the Warnings issued and the Weather experienced in 1887.

Coasts.	Total No. of Orders to hoist and repetitions.	Warnings justified by subsequent Gales. Force 8 and upwards.	Warnings justified by subsequent strong Winds. Forces 6 and 7.	Warnings not justified by subsequent Weather.	Warnings late. Force 9 reached at two Stations before issue.	Warnings partially late. Force 9 reached at one Station before issue.	Warnings in Error owing to telegraphic mistakes.	Storms for which no Warning was issued.
Ireland, South -	58	32	12	12	—	1	1	Jan. 3.
„ East -	68	34	20	12	—	1	1	——
Scotland, East -	62	37	13	11	—	1	—	——
„ West -	52	25	18	8	—	1	—	Dec. 17.
England, North-west	57	42	5	8	—	1	1	Dec. 17.
„ West -	42	19	17	5	—	—	1	Dec. 6.
„ South-west	38	22	8	7	—	—	1	Dec. 6.
„ South -	34	19	10	5	—	—	—	March 31, April 6.
„ South-east	29	15	12	2	—	—	—	April 6.
„ East -	32	17	8	7	—	—	—	——
Totals - -	472	262	123	77	—	5	5	
Per-centages -	—	55·5	26·1	16·4	—	1·0	1·0	

NOTES as to GALES in 1887 for which WARNINGS were not issued.

Gale of January 3rd, in Ireland, S.—This gale came on suddenly early on January 3rd, but at 6 p.m., on the 2nd, there was no indication of its approach.

Gale of March 31st—April 1st, in England, S.—This was a local extension of a Northerly gale, which was felt on many parts of our coasts during the night of March 31st—April 1st. The other coasts were all duly warned, but there was no reason to suppose that the south coast would feel much of it, and in fact Hurst Castle and the Owers Lightship were the only stations which reported it as a strong gale.

Gale of April 6th in England, S. and S.E.—North-easterly winds were setting in on the evening of the 5th, and the northern and north-eastern parts of our Islands were warned. During the night, however, the barometer rose very quickly in the N., and as the change spread rapidly the gradients became steep in the S.

and S.E., and the gale set in before morning. I do not see how this mistake was to be avoided. Storm warnings.

Gale of December 6th, in England, W. and S.W.—A Southerly and South-westerly gale, caused by the approach of a deep depression to the Hebrides during the night of December 5th–6th, and a "V"-shaped secondary to the Irish Sea. Of the advance of the latter which caused the gale in question, there was no indication at 6 p.m. on the 5th; the more northern of our western coasts were duly warned.

Gale of December 17th, in Scotland, W., and England, N.W.—At 6 p.m. on the 16th there was a large depression in the N., moving eastwards, and having slight gradients near its centre. A rapid rise of the barometer in the W. and S.W. during the night caused an increase of the gradient on our north-western coasts, and hence the gale,—which, however, was duly warned for on the other coasts.

The following table contains a comparative statement of the storm warnings and their results in 1887, and in the ten preceding years. It will be seen that the percentage of warnings justified is slightly lower than in the preceding year:— Comparison of results for 1887 with previous years.

Years.	Total No. of Warnings issued.	Warnings justified by subsequent Gales.	Warnings justified by subsequent strong Winds.	Total Warnings justified.	Warnings not justified by subsequent Weather.
1877	475	58·3	25·9	79·2	16·4
1878	485	56·7	20·8	77·5	17·9
1879	509	50·5	25·1	75·6	20·6
1880	390	58·2	24·6	82·8	13·3
1881	454	58·6	23·3	81·9	14·8
1882	503	61·4	21·1	82·5	14·9
1883	610	56·2	21·6	77·8	20·8
1884	461	66·4	20·0	86·4	12·1
1885	591	55·3	24·0	79·3	19·5
1886	542	55·3	26·9	82·2	15·9
1887	472	55·5	26·1	81·6	16·4

Fishery Barometers.—In connexion with the subject of storm warnings the supply of public barometers on loan to fishing stations and other places on the coast should be mentioned. The whole number of stations supplied by the Office with these instruments is 167. Of these stations, 57 are in England, 5 in Wales, 46 in Ireland, 55 in Scotland, 3 in the Isle of Man, and 1 in Jersey. The list is given in Appendix IX., p. 95. Fishery barometers.

As in many cases a long time had elapsed since the issue of these instruments, circulars were issued in the course of the year to collect information as to their present condition. The replies have been of a satisfactory nature. In the great majority of cases the barometers are stated to be well cared for and prized by the fishing population of the respective districts.

Fishery barometers.

The Council propose, as opportunity offers, to have the several stations visited, and, if possible, to provide the means of giving oral explanations to fishermen and others of the utility of these instruments in connexion with weather forecasting. A commencement has already been made with these visits on parts of the coast between Edinburgh and Dundee, and the results appear to justify the further prosecution of the plan.

The new edition of the Fishery Barometer Manual was issued during the year, and has been distributed to the fishery barometer stations as indicated in last report.

Distribution of gales on the coasts.

Distribution of Gales on the Coasts of the British Isles.—In last year's report a table was given showing the relative prevalence of gales in the four quadrants (N. to E., E. to S., &c.) in different districts of the coast. A further investigation has been made of the distribution of severe local gales in different districts. The result is given in Note B. (p. 26).

Observations on Ben Nevis.

Observations on Ben Nevis.—The arrangements with the Directors of the Observatory established on the summit of Ben Nevis, at a height of 4,406 feet above the sea, detailed in the Report for 1885, have been continued during the year. The Council have continued the annual grant of 100*l.* towards the expenses of the observatory, and have received MS. copies of all the meteorological observations taken. No telegrams have been received from the summit during the year.

The Council have been in communication with the Directors of the Observatory regarding its present condition, and certain contemplated arrangements in connexion with it; and with reference to these, the Council resolved to make proposals to the Directors for co-operation, and the grant of further pecuniary aid, subject to conditions which are under their consideration.

Atlantic telegrams.

Atlantic Telegrams.—The transmission of these telegrams which give a general summary of the principal features of the atmospherical conditions over the United States, supplemented by ship reports, have been continued during the past year.

As explained in last year's report, this service has been carried on conjointly by the Central Meteorological Office in Paris and the Meteorological Council, and it was continued for about 18 months, the telegrams being received in Paris, and their contents transmitted to London by post. The collection of the information and transmission of the telegrams is undertaken by the Chief Signal Office, Washington, whose staff in New York and Boston are charged with the execution of the duty.

The conclusion having been come to that the information conveyed by these telegrams has not been of any practical utility in the issue of forecasts and storm warnings, the Council have resolved to discontinue their participation in the payment for their transmission. This step was not taken without consultation with the eminent Director of the Paris Meteorological Office, who was unable to satisfy the Council that any practically useful result had been obtained by their means at that Office. Although Mons.

Mascart proposes to continue the service for a further period, the Council did not feel themselves justified in applying the funds at their disposal to this object for the reasons now explained. They have, however, invited M. Mascart to let them hear if he is able to make a more favourable report regarding the telegrams, and as he has offered to supply copies of them, for transmission by post to London, they will continue to be watched here in connexion with this branch of the Office. Atlantic telegrams.

Some remarks on the probable value to this country of such a service of telegrams as indicated by the consideration of the Atlantic Weather Charts will be found in Note A., p. 22.

Weather Reports.—The Daily Weather Report has appeared regularly, and has again been added to. For details, see Appendix VII., p. 81. Publications.

The Weekly Weather Report has appeared in its enlarged form, as explained in the last Report, and has been further improved by the addition since 1st January 1887, of six new stations situated in the inland districts of Scotland.

The Quarterly Summary, issued as Appendix I. to the Weekly Weather Report, gives the Monthly and Progressive values of Accumulated Heat, Rainfall, and Bright Sunshine for all the districts in each month of the current year—in continuation of the Tables published in Appendix I. for 1886. Appendix II. to the same Report gives the Weekly and Progressive values for the same elements during the year 1887 (in continuation of Appendix II. for the year 1886), and Appendix III. gives the *Mean* Weekly values for the following number of years:—

Accumulated Heat and Rainfall,	9	years,	1878	to	1886.
„ „ „	10	„	1878	„	1887.
Bright Sunshine - -	6	„	1881	„	1886.
„ - -	7	„	„	„	1887.

Appendix IV. gives for each district, (*a*) for the eight years 1878 to 1885, (*b*) for the nine years 1878 to 1886, and (*c*) for the 10 years 1878 to 1887, the mean temperature of the air for each week in the year. This Appendix is new.

The Monthly Weather Report for 1887, which has fallen into arrear, will shortly be published.

Simultaneous Observations.—The Office has continued its co-operation in the system of International simultaneous observations, taken at Greenwich mean noon, which was organised in 1874, at the request of the Chief Signal Officer of the United States. Simultaneous observations.

The list of observers on this system at land stations for 1887 is given in Appendix XII., p. 103.

A form for the entry of the simultaneous observations is bound up with every ship's log issued by the Office. In previous Reports it has been stated that the Lords Commissioners of the Admiralty had, at the request of the Council, issued instructions for these observations to be taken (in addition to those made by the Service Regulations) on board each detached ship-of-war on foreign service; or, in the case of a squadron acting together, on board the ship of the senior officer. The number of these

Simultaneous observations.

observations which have been received during the year from the Royal Navy has been 7,490, and from the Mercantile Marine, 6,690.

PART III.

Land Meteorology of the British Isles.

Observatories and Stations.—Records of the climate of the British Isles are received by the Office from certain stations with different degrees of fulness of organisation, which may be arranged in five classes.

Self-recording observatories.

1. The Observatories furnished with self-registering instruments by which all the principal meteorological phenomena are recorded continuously, and which thus afford materials for the study of the periodic variations of the meteorological elements.

Anemographic stations.

2. Anemographic stations furnished with instruments registering the wind only. The records from these stations relate to weather as distinguished from climate, and are especially useful in connexion with the passage of storms, and as affording evidence available in the courts of law with respect to collisions at sea, and damage done by wind.

Stations of Second Order.

3. Stations of the Second Order furnishing climatological information from eye observations taken twice a day. The observers at these stations are all volunteers.

Telegraphic Reporting Stations.

4. The Telegraphic Reporting Stations at which eye observations are taken, supplemented in some cases by self-recording aneroids, &c., forming the material upon which the daily weather reports and forecasts are based. The hours of observation at these stations are limited by the requirements of the telegraphic system, as explained in Part II., but the data which they furnish are utilized to afford climatological information for parts of the country where Stations of the Second Order do not exist.

Extra stations.

5. Extra stations furnishing returns with less completeness, and with less detail than those of class 3.

Sunshine stations.

A continuous record of the amount of bright sunshine is received from 35 stations in the British Isles, some of which are first or second order stations, whilst from others the sunshine record is alone received. See p. 112.

A fuller account of these several stations and of the methods employed by the Office in dealing with the records will be found in Appendix XIII., p. 104, and a Map of all the stations is appended to Note D., p. 33.

Documents received.

Appendix XIV., p. 108, contains a list of all documents relating to the land meteorology of the British Isles received at the Office during the year.

The only changes in the self-recording stations during the year have been the erection of two anemometers of a smaller size during the year, one at the Mountjoy Observatory, Phœnix Park, Dublin, the other in the Island of Heligoland.

Inspection of Stations.

Inspection of the Stations.—The self-recording observatories and the anemographic stations (Classes 1 and 2), as well as the Tele-

graphic Reporting Stations (Class 4), are regularly visited each year by the Inspectors of the Office before mentioned (p. 10). The extra stations (Class 5) are inspected as opportunity offers. Of the Stations of the Second Order (Class 3), some belong to the Royal Meteorological Society; these are visited by an Inspector appointed by the Society, an allowance being made by the Office toward the cost of the inspection, in accordance with the recommendation of the Treasury Committee (1877); and some belong to the Scottish Meteorological Society. The remaining Stations of the Second Order are visited at least once in every two years by the Inspectors of the Office. The Superintendent of the Kew Observatory, Mr. G. M. Whipple, is specially employed to inspect and report on the self-registering apparatus, and on the photographic processes at the observatories. Extracts from the Reports of the Inspectors will be found in Appendix VI., p. 64.

Inspection of Stations.

Information supplied to the General Register Office, Dublin.—Reports from ten of the Irish stations of the Office have been regularly supplied to the Registrar General for Ireland, for use in his Weekly and Quarterly Returns.

Reports supplied to Registrar General for Ireland.

Quarterly Weather Report.—Parts I. and II. of the volume for 1879 in the old form have appeared, and the volume will soon be completed. This form of Report will end with the publication of the results for 1880.

Publications.

The volumes of the *Monthly Weather Report* for 1887 and 1888, some parts of which have appeared, will soon be completed and issued. This publication takes the place of the Quarterly Weather Report.

The publication of the *Hourly Readings* obtained from the records of the self-registering instruments at the four principal observatories for 1885, is nearly completed.

Reports from Stations of the Second Order.—The volume for 1883 has appeared, and that for 1884 is in an advanced state.

Electric Anemometer.—This instrument has now been erected at Kilbeg Hill, situated above and at a distance of about a mile from the observatory at Valencia, but various unforeseen difficulties have arisen in connexion with the mechanism, and it has not yet been brought into operation.

Electric Anemometer.

The Harmonic Analyser.—The results of the analysis of the thermograms for the 12 years 1871–82 appeared as an appendix to the volume of Hourly Readings for 1883. They are given in three tables, of which the first two contain, in different forms, the harmonic coefficients of the first three orders of the formulæ expressing the diurnal variation of temperature; while the third, by a comparison of the monthly mean values obtained from the hourly values by computation with those derived from the analyser, supplies a means of testing the accuracy with which the machine works. The barograms are now being dealt with in a similar manner, and are finished up to the end of 1879.

Harmonic Analyser.

Hygrometrical investigations.

Experiments on Hygrometry and Evaporation.—In the report of the Office for 1883, it was mentioned that an investigation of this nature had been entrusted to Mr. W. N. Shaw, M.A., of Emmanuel College, Cambridge, and that a preliminary report on Evaporation from his pen had appeared in the Quarterly Weather Report for 1877. Mr. Shaw has continued his researches, and in the course of last autumn forwarded to the Council a report on Hygrometric Methods, which has been considered by them of such importance that it has been forwarded to the Royal Society. It has been accepted for publication in the Philosophical Transactions, and will be reprinted by the Office in the volume of the Quarterly Weather Report for 1879, now in the press. An abstract of this report, reproduced from the proceedings of the Royal Society, is given in Note C., p. 30.

Cloud photography.

Cloud Photography.—In the report for the year ending March 31, 1886, at p. 22, mention was made of a series of cloud photographs which had been taken at the Kew Observatory, by the use of two cameras at a distance of 800 yards apart. The photographs obtained have been measured in the manner described in the report quoted, but it has appeared to the Council desirable to have the measurements repeated, by an independent investigator, before publishing results. This re-measurement is now in progress, and the photographs continue to be taken when the conditions are favourable.

International Tables.

International Meteorological Tables.—At the International Congress of Rome in 1879 it was decided that it was desirable that an authoritative series of tables for use in meteorological and other scientific reductions should be prepared and issued, the necessary funds being raised by international subscription. The subject was entrusted to Professor E. Mascart, of Paris, and Professor H. Wild, of St. Petersburg. The computation of the tables is now nearly complete, and the work is in the press. The Council have agreed to contribute their share of the necessary expenditure, by purchasing a number of copies of the work.

Krakatoa Report.

Krakatoa Eruption.—The report on the air-waves caused by the explosion that attended this eruption was submitted in June 1886 to a Committee appointed by the Royal Society; but during the past year, while the sheets have been passing through the press, a great deal of additional work has been done upon the entire report, in checking statements as to positions of vessels, distances from Krakatoa, numerical calculations, &c., and in carefully reading the sheets with a view to secure uniformity among the authors with reference to the facts and data mentioned.

Records from stations of the Army Medical Department.

Records from Military Stations.—In the year 1886 the Office received a contribution to its records of the climatology of the globe of considerable value in a complete series of the observations made by the officers of the Army Medical Department, at both home and foreign stations, during the years 1866–1884. These returns, together with those made by the Royal Engineers in the years 1852–1862, which were received from the

Records from stations of the Army Medical Department.

Office of the Ordnance Survey in 1879, supply information as to the climate of many parts of the world about which comparatively little is at present known, and the Council, therefore, decided to publish the returns from all the foreign stations on a definite system, in the form of monthly means and summaries, so that this information may be generally accessible to meteorologists. It has also been decided to obtain from the Army Medical Department the returns for the years 1885–6, and to include these results in the publication. A list of stations will be found in Appendix XIVA., p. 113.

This work is now nearly completed and will be published during the present year.

Library.

Library.

The library contains standard works on Meteorology and the allied sciences. It consists at present of nearly 11,000 volumes and pamphlets, exclusive of charts and MS. records of observations. The books and other documents are accessible to scientific men for reference at the Office.

Appendix XV., p. 115, contains a list of the additions to the library during the year. These have been catalogued upon cards as before, besides being entered in the reference catalogues under (1) Authors, and (2) Subjects.

Expenditure.

Financial.

Appendix XVI., p. 143, shows the receipts and payments during the year ending 31st March 1888. The amount voted by Parliament was 15,300*l.*, as in the previous year.

The following abstract of expenditure shows the amount *properly chargeable* to the year in question, and its distribution under the various heads, together with the increase or decrease in 1887–88, as compared with the previous year :—

Net Expenditure.	1886-87.	1887-88.	Increase.	Decrease.
General Administration.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Payment of Council -	1,000 0 0	1,000 0 0	—	—
Secretary - -	800 0 0	800 0 0	—	—
Office - - -	792 12 0	806 15 6	14 3 6	—
Rent, fuel, and lighting -	721 6 1	738 17 10	17 11 9	—
Alterations to premises, attendance, and contingencies - -	596 19 1	437 5 11	—	159 13 2
Expenses incidental to International Meteorological Congress -	11 0 0	—	—	11 0 0
Pensions - -	42 16 4	42 16 4	—	—
Special Researches -	494 12 3	734 11 10	239 19 7	—
Land Meteorology -	3,207 15 4	3,141 10 10	—	66 4 6
Weather Information -	3,681 6 5	3,929 15 5	248 9 0	—
Inspections - -	559 16 9	524 10 4	—	35 6 5
Ocean Meteorology -	2,924 8 1	2,517 4 6	—	407 3 7
Total - £	14,832 12 4	14,673 8 6	520 3 10	697 7 8

(Signed) Richard Strachey,
Chairman.

NOTE A.

On the HISTORY of the SEVERE STORMS which visited the BRITISH ISLES between August 1, 1882, and September 3, 1883, as traceable from the ATLANTIC CHARTS published by the Office. By ROBERT H. SCOTT, F.R.S., Secretary.

The most obvious mode of discussion of the possibility of obtaining practically useful information as to probable weather on our coasts from telegraphic reports sent from America is to trace the movements of the several cyclonic systems which show themselves day by day on the charts in their passage across the Atlantic. I have prepared a series of 13 charts, one for each month, showing the tracks of all the clearly marked barometrical depressions, or cyclonic systems, I was able to recognize as having been accompanied by gales. As the Atlantic charts are drawn at intervals 24 hours apart, it is evident that they cannot afford as complete a history of the phenomena as if charts for more frequent intervals were available, accordingly it is not improbable that more complete information might have shown that some of the connexions between storm positions on successive days were not well founded, and that some storms were not really so long lived as my preliminary investigation would appear to show. In fact the phenomenon of the complete dying out of an atmospheric eddy, and of the appearance of a fresh disturbance in its vicinity is not very uncommon.

In many cases cyclonic systems coming from low latitudes appear to merge in a large area of depression, which is very generally prevalent over the region stretching from Baffin's Bay to Iceland, and it is a matter of uncertainty whether a system of cyclonic wind circulation, which apparently disentangles itself from this region, and advances over Iceland to Europe, is really the same system that moved up to Davis Straits a few days before. I have, however, assumed that this last-named sequence of conditions has taken place. Another very common occurrence, which often gives the appearance of a recoil of the advancing storm, or of a kink in its track, arises when an area of depression, say with readings as low as 29·4 inches, is extremely elongated, being either oval or even lemniscate-, or kidney-shaped. Under such circumstances the barometer at one focus of the ellipse frequently falls lower than at the other, but if this relation be not permanent, and if for instance the readings at the eastern focus become higher, while the western disturbance becomes more accentuated, the resulting appearance is that the storm as a whole has receded. Again, such an oval may extend from Iceland to the Bay of Biscay, and if the centre of chief disturbance was situated at first over Iceland, and next day near Biarritz, the track chart would make it appear that the storm had travelled over the entire distance named in 24 hours. That this had really happened is not very probable.

The total number of depressions whose tracks appear in the 13 charts does not fall far short of 250, but out of these there are a limited number which present special interest to us in the British Isles, in fact, those which produced gales on our coasts.

For the purposes of a paper entitled "The Equinoctial Gales —do they occur in the British Isles?" which I prepared for the Royal Meteorological Society, and which was printed in their Quarterly Journal, Vol. X., p. 236, I drew up a list of all the serious storms which had occurred on our coasts between 1870 and 1884. In the interval covered by the Atlantic charts, from August 1, 1882, to September 3, 1883, the number of such storms recorded on our coasts was 37, and the dates were as follows:— 1882, August 23; September 2; October 1, 19, 24, 28; November 1, 4, 5, 8, 14, 16, 20, 28; December 2, 5, 7. 1883, January 2, 10, 14, 19, 24, 25, 27, 28; February 1, 6, 9, 12, 14, 17; March 6, 8, 17, 22, 29; April 17; September 1.

These have been arranged in four classes:—

A	17	in No.	- Those first appearing to the westward of the meridian of 40° W.
B	8	„	- Those first appearing in mid-Atlantic.
C	9	„	- Those first appearing over the British Isles, often being secondary to large depressions outside.
D	3	„	- Those first appearing to the eastward or over Europe.
Total	37		

It is evident that for the purpose of ascertaining the possibility of obtaining from American telegrams warning of these storms, we need only consider class A, for unless a storm is distinctly recognisable in the United States either by cloud observations or from ship logs received at American ports, no telegram of a positive character regarding it can be despatched. It seems reasonable to assume that unless a storm has manifested itself within the limits bounded by the parallels of 40° and 52° N. (Philadelphia and Straits of Belle Isle), and on the western side of the meridian of 40°, it would not be possible for a report of it to be made early enough for anyone in the United States to telegraph its probable approach to Europe in time to be of any practical utility.

Out of the 17 storms of Class A only 12 can be considered as fulfilling this condition of passing at some time of their course within the area specified.

In order that warnings of storms should be effectual, some judgment must be formed as to the probable length of time required for them to cross the Atlantic. If we assume, for the sake of argument, three days as a fair average time for crossing, it is evident that a storm travelling either much faster or slower than this will either outstrip the warning or be "distanced" by it.

In the first case the warning must be a practical failure, and in the second its utility rendered very doubtful.

Of these 12 storms, four, those of February 1, 9, 14, and September 1, 1883, crossed apparently in two days; three, those of October 1, December 2 and 7, in three days; one, January 14, in four days; one, February 17, in five days; two, September 2 (1882) and November 20, in six days; and finally one, November 4, took 10 days to cross. It will be seen from this that the chances of success in the 13 months investigated lay heavily against any American forecaster.

Let us now consider these 12 storms more in detail.

September 2nd, 1882.—The storm appeared first on August 26th in 42° N. 58° W. It crossed the Atlantic in a nearly straight line, and on September 2nd its centre lay over Sutherlandshire.

October 1st.—This commenced in a very low latitude in 22° N. 59° W. September 22nd. It took the regular course of a West India Hurricane, recurving near Bermuda and crossing the ocean on the parallel of 42° N.; it finally rose to 51° N. in 18° W. and there died out on the 2nd of October.

November 4th.—This commenced near the Havana on October 21st. It travelled along the American coast till it reached the latitude of 53° N. to the north of the straits of Belle Isle. It crossed the ocean very slowly, approached closest to us on November 1st, then recoiled and again approached us on the 4th, at which time its centre lay over the Faroes, and on this day, and *not before*, it produced a gale.

November 20th.—This commenced in 43° N. 98° W. not far from Omaha on the 10th, on the 14th its centre lay near Anticosti. It then travelled due north for two days, crossed Greenland and reached Iceland on the 18th, whence its track was south-eastward. Its centre lay near Barra Head in the Hebrides on November 20th, the day of the storm.

December 2nd.—This track is almost exactly parallel to the foregoing. The storm commenced in the Gulf of Mexico; on the 20th November it travelled along the coast to Cape Breton Island, where its centre lay on the 30th. Its track then lay northwards to near Cape Farewell, and then eastwards to Iceland, whence it moved south to 61° N. 18° W. on the 4th. The gale with us occurred on the 2nd, when the centre lay off Iceland in 63° N. 21° W.

December 7th.—This first appeared near Lake Erie on the 2nd of the month. It travelled rapidly and its centre lay close to Cherbourg on the 7th, the day of the gale.

January 14th.—This storm started from the coast of Florida on the 9th, on the 11th its centre lay near Cape Race, then it apparently dipped down about five degrees of latitude, and thence travelled north-eastwards, producing a gale on our coasts when its centre lay in 23° W. 52° N.

February 1st.—This started on Lake Huron on the 27th; then apparently it dropped to the south of Kentucky in 24 hours, thence it travelled on a straight east-north-east course with great rapidity, passing over forty degrees of longitude in 48 hours. Our gale was felt when the centre was in 20° W.

February 9th.—This also apparently travelled with great speed. Its centre lay on the 7th near Kingston (Canada), on the 8th it had reached 43° W., and on the 9th, when we had our gale, the centre lay in 30° W.

February 14th and 17th.—These were two gales produced by the same cyclonic disturbance at different periods of its existence. The depression originated over Lake Superior on the 11th. It travelled very rapidly, and in three days the centre lay in 21° W. 54° N., and we had a storm. The depression passed northwards, and on the 17th, when the centre lay off the north-west point of Iceland, we had another gale. This latter was probably due in part to a rise of the barometer over the Baltic, and in

part to the formation of an imperfect secondary depression off our north-west coasts on the 17th.

September 1st, 1883.—This followed a course very similar to that of October 1st, 1882, above-mentioned; it arose near the Island of Porto Rico, skirted the coast of North America, crossed the Atlantic about 48° N., and its centre on the 1st lay just outside Scilly.

The great irregularity which is shown, by the above remarks, to exist between these storms as to their tracks and rate of advance, proves that any attempt to telegraph storms from America to Europe, with the means at present available, must be beset with great difficulties.

A further investigation of the Atlantic Charts showed that for a protracted interval in the month of March 1883, a band of high barometrical readings stretched across the North Atlantic from north to south, between the meridians of 20° and 40° W. This formed an absolute barrier to the advance to Europe of any storm from the westward, and of its existence and persistence no official in America could have any sufficient knowledge, and any forecaster might easily forward useless telegrams.

The general outcome of the investigation has been to show that it is extremely improbable that telegraphic reports of weather received from the other side of the Atlantic could be of a nature to assist in the forecasting of weather on our coasts, and this conclusion is fully sustained by the actual results of the experimental system of reporting which has been in operation during the past year.

NOTE B.

REPORT on the SEVERE PARTIAL GALES experienced on the Coasts of the British Islands, during the 15 Years 1871 to 1885.—By F. J. BRODIE, F.R. Met. Soc.

Meteorological Office. Telegraph Branch.

A minute examination into the circumstances under which each of these gales occurred seems to show that they may fairly be classified under one or other of the following headings:—

a. Gales which were more or less general in the neighbourhood of the district, but which were felt only locally in the district itself.

b. Gales which extended from adjacent coasts to the borders of the district in question.

c. Gales which were occasioned by depressions skirting our coasts, and only affected portions of the districts near which they passed.

d. Gales which were local only as regards *direction* of wind, storms from other quarters being felt on adjacent coasts.

e. Gales which were the effect simply of very small systems (or "swirls"), and were consequently felt only over limited portions of the districts visited.

f. Gales which were felt in a part of one district only.

g. Gales which, though reported, were in all probability so reported owing to an error in judgment of the observer.

In the table herewith the results of this classification are given for each district, and also for the various quarters from which the gales were experienced.

The aggregate values for the whole of the districts are given at the foot of the table, and show:—

1. That in 46 per cent. of the cases the gales, although more or less general in the neighbourhood of the district, were felt only locally in the district itself. In many instances it is difficult to see why certain of the stations should have failed to record the gale. As regards the telegraphic reporting stations, however, there can be little doubt that the occurrence of a gale during the night frequently escapes the notice of the observer.
2. It would appear that a considerable number (21 per cent.) of instances were due to the extension of storms from other coasts to a portion of the districts in question.
3. That in 11 per cent. of the cases the gales reported indicate, in all probability, an over-estimation of wind-force.

4. That in some few instances (8 per cent.) the gales were occasioned by depressions skirting our coasts, and only affecting portions of the districts near which they passed.
5. That in six per cent. of the cases the gales were purely local, no other district being affected.
6. That in six per cent. of the cases the gales were the effect simply of local squalls. In cases where these squalls were felt only in one district, the gale was of course classed under the previous heading.
7. That in the remaining instances (2 per cent.) the gale was local only as regards the *direction* of the wind, storms from other quarters being felt on adjacent coasts.

TABLE showing the NUMBER and NATURE of the SEVERE PARTIAL GALES experienced on the COASTS of the BRITISH ISLANDS during the years 1871 to 1885.

DISTRICTS.	Quarter from which the Gale blew.	Total Number of Severe Partial Gales experienced.	Classification of Gale.							REMARKS.
			Gales more or less general in the Neighbourhood of the District, but felt only locally in the District itself.	Gales extending from adjacent Coasts to borders of Districts.	Gales caused by Depressions just skirting Districts.	Gales local only as regards *Direction* of Storms from other quarters felt on adjacent Coasts.	Gales the effect simply of local Squalls.	Gales purely local. No other Districts affected.	Gales probably reported in error owing to overestimation of Wind-Force.	
E. SCOTLAND	From between N. and E. by N.	3	1	1	0	0	0	0	1	The two instances given under the first heading are somewhat doubtful. In each case the gale was felt in the N.E. of England, as well as in the Nn. part of Scotland, and it seems almost impossible that the Sn. part of the district should have escaped.
	„ E. and S. by E.	5	2	0	0	1	0	1	1	
	„ S. and W. by S.	9	3	2	3	0	0	0	1	
	„ W. and N. by W.	7	3	0	2	0	0	2	0	
	From all directions	24	9	3	5	1	0	3	3	
N.E. ENGLAND	From between N. and E. by N.	2	1	0	0	0	0	1	0	The gale inserted under the last heading is very doubtful. The only station on our E. coast which was affected by the gale was Whitby.
	„ E. and S. by E.	2	2	0	0	0	0	0	0	
	„ S. and W. by S.	20	1	15	0	0	3	0	1	
	„ W. and N. by W.	8	0	6	0	0	1	0	1	
	From all directions	32	4	21	0	0	4	1	2	
E. ENGLAND	From between N. and E. by N.	2	2	0	0	0	0	0	0	
	„ E. and S. by E.	2	1	1	0	0	0	0	0	
	„ S. and W. by S.	1	0	1	0	0	0	0	0	
	„ W. and N. by W.	2	0	2	0	0	0	0	0	
	From all directions	7	3	4	0	0	0	0	0	
S. ENGLAND	From between N. and E. by N.	0	0	0	0	0	0	0	0	
	„ E. and S. by E.	0	0	0	0	0	0	0	0	
	„ S. and W. by S.	4	2	0	0	0	2	0	0	
	„ W. and N. by W.	4	3	0	0	0	1	0	0	
	From all directions	8	5	0	0	0	3	0	0	

N.W. Scotland	From between N. and E. by N.	4	4	0	0	0	0	0	0	Many of the severe partial gales in this district were reported at Stornoway only. The observer at that station had apparently a tendency to over-estimate the wind-force, but taking into account the exposed situation of the place, it is impossible to say that severe local squalls do not occur there.
	„ E. and S. by E.	2	2	0	0	0	0	0	0	
	„ S. and W. by S.	20	6	0	10	0	3	0	1	
	„ W. and N. by W.	7	4	3	0	0	0	0	0	
	From all directions	33	16	3	10	0	3	0	1	
N. Ireland	From between N. and E. by N.	1	0	1	0	0	0	0	0	
	„ E. and S. by E.	3	1	2	0	0	0	0	0	
	„ S. and W. by S.	5	1	2	1	0	0	0	1	
	„ W. and N. by W.	6	5	1	0	0	0	0	0	
	From all directions	15	7	6	1	0	0	0	1	
Irish Sea	From between N. and E. by N.	4	2	0	0	1	0	0	1	
	„ E. and S. by E.	9	5	1	0	0	0	0	3	
	„ S. and W. by S.	10	6	1	0	1	0	0	2	
	„ W. and N. by W.	10	6	1	0	0	0	1	2	
	From all directions	33	19	3	0	2	0	1	8	
S.W. England	From between N. and E. by N.	3	1	0	0	0	1	0	1	
	„ E. and S. by E.	7	5	0	0	0	0	0	2	
	„ S. and W. by S.	4	2	0	0	0	0	0	2	
	„ W. and N. by W.	6	4	0	0	1	0	1	0	
	From all directions	20	12	0	0	1	1	1	5	
S.W. Ireland	From between N. and E. by N.	2	1	0	0	0	0	1	0	
	„ E. and S. by E.	1	1	0	0	0	0	0	0	
	„ S. and W. by S.	9	8	0	0	0	0	0	1	
	„ W. and N. by W.	8	3	0	0	0	0	5	0	
	From all directions	20	13	0	0	0	0	6	1	
All Districts	From between N. and E. by N.	21	12	2	0	1	1	2	3	
	„ E. and S. by E.	31	19	4	0	1	0	1	6	
	„ S. and W. by S.	83	29	21	14	1	8	0	9	
	„ W. and N. by W.	58	28	13	2	1	2	9	3	
	From all directions	193	88	40	16	4	11	12	21	
	Per-centages	—	46	21	8	2	6	6	11	

NOTE C.

ABSTRACT of a REPORT on HYGROMETRIC METHODS, by W. N. SHAW, M.A., reprinted from the "Proceedings of the Royal Society," No. 262.

With the exception of certain "absolute hygrometers," the behaviour of which has not yet been sufficiently tested, the determination of the pressure of water vapour in the air is indirect, and requires a formula of reduction. The formulæ in use are based upon assumptions which are at present not so completely verified by experiment that any hygrometric method can be relied upon to give measures of the pressure of aqueous vapour trustworthy to within 0·1 mm. of mercury. The authority for these statements is given in detail in an account of the hygrometric work done since 1830. This account is appended to the report as Note A.

In the report, the chemical hygrometric method is provisionally regarded as a standard. The formula of reduction applicable in this case is—

$$e = \frac{760\,(1 + at)}{\Delta d}\, f.$$

where e is the pressure of aqueous vapour in millimetres; f the number of grammes of moisture per cubic metre in the air at temperature t° C.; a the coefficient of expansion of air per degree C; Δ the density of dry air at 0° and 760 mm., *i.e.*, 1293 grammes per cubic metre; and d is the specific gravity of the moisture referred to air at the same temperature and pressure.

The assumptions upon which the formula is based are—(1.) That it is possible to absorb the whole of the moisture from air by passing it over desiccating substances; and (2) that a numerical value can be assigned to d. The first assumption has been discussed by Regnault and others, and is sufficiently nearly accurate for all hygrometric calculations. With regard to the second, Regnault's direct observations upon steam (free from air) and other evidences point to the value 0·622. The assumption can, moreover, be tested by applying the chemical method to air saturated at a known temperature, assuming the value 0·622 for d, and comparing the results with the table of saturation pressures *in vacuo*. This, however, *assumes Dalton's law to be strictly accurate*, an open question, upon which opinion is reserved until further experimental investigation is concluded. Regnault made the comparison in 68 experiments, in 59 of which the air was practically saturated when it entered the drying tubes. For these he found that the value 0·622 gave results which were less than the tabulated pressure, the errors being always of the same sign, but so small in amount that he neglected them in his subsequent work.

The ultimate object of the experiments described in the report was to examine the behaviour of dew-point instruments in air of

known state, and for this purpose air was saturated at a known temperature, and drawn by an aspirator through vessels in which the dew-point instrument could be placed when required, and subsequently through drying tubes of special pattern. The vapour-pressure was thus obtained at the two extremities of the train of apparatus and the results compared.

The following questions are raised and discussed:—

i. Were the drying tubes used as efficient as Regnault's?

ii. Does the pressure of vapour in the air become changed by passing through the apparatus designed to contain the dew-point instruments, or by the mere presence of those instruments themselves?

iii. Do the results of the chemical method agree with the tabulated vapour-pressures *in vacuo* when the air is more or less heated after being saturated?

iv. Can the observed differences between the results be obviated by assuming the value for d (other than 0·622) which is compatible with values obtained by other methods?

v. Can any reason be assigned for the differences observed by Regnault in the case of saturated air?

(i.) The answer to the first question is given in an account of a series of 12 experiments practically repeating Regnault's observations with saturated air. The tabulated results show divergences in the same direction and of the same order of magnitude as those in Regnault's paper. Some incidental points are also discussed, namely, the comparative efficiency of phosphoric anhydride, sulphuric acid, and calcium chloride, and the effect of india-rubber and glass connexions between drying tubes. It is shown that the sulphuric acid and phosphoric anhydride tubes are efficient, that, as a rule, one tube is all that is strictly necessary, but that two should be used to provide for the case of exhaustion of the first tube or too rapid flow of air, and further, that the glass and mercury connexions between the tubes employed in the second series of experiments cannot be regarded as producing any effect.

(ii. and iii.)—The answers to the second and third questions are furnished by the results of 82 experiments with the chemical method upon air saturated at known temperatures by a specially designed "saturator" in a water bath. The temperatures of saturation lay between 1° C. and 21° C., and, with one exception, were below the temperature of the surrounding air. Each experiment involved upwards of 30 readings of weight, pressure, and temperature. The temperature readings were corrected by means of a special comparison at Kew. Of the 82 observations 32 are retained as being free from any known disturbing causes, and from them it appears that, with d equal to 0·622, the pressure deduced by the chemical method is on the average greater by 0·03 mm. than that given in Regnault's table of vacuum pressures, as re-calculated in Landolt and Börnstein's

tables. This difference is very small compared with the discrepancies from Dalton's law observed by Regnault in the case of water vapour.

(iv.) With regard to the fourth question; if the observations be employed to determine the value which must be substituted for d, the specific gravity of saturated steam referred to air at the same temperature and pressure, the mean value of d so obtained is 0·6245, which agrees very closely with 0·6240, the mean value for the same range of temperature deduced from Clausius's calculations based on thermo-dynamical reasoning. The value 0·622 is probably correct if the air is not nearly saturated; in that case the measure of the pressure of vapour in the air is 2/622 greater than it would be if the same air were reduced in temperature (at constant pressure), until it was saturated.

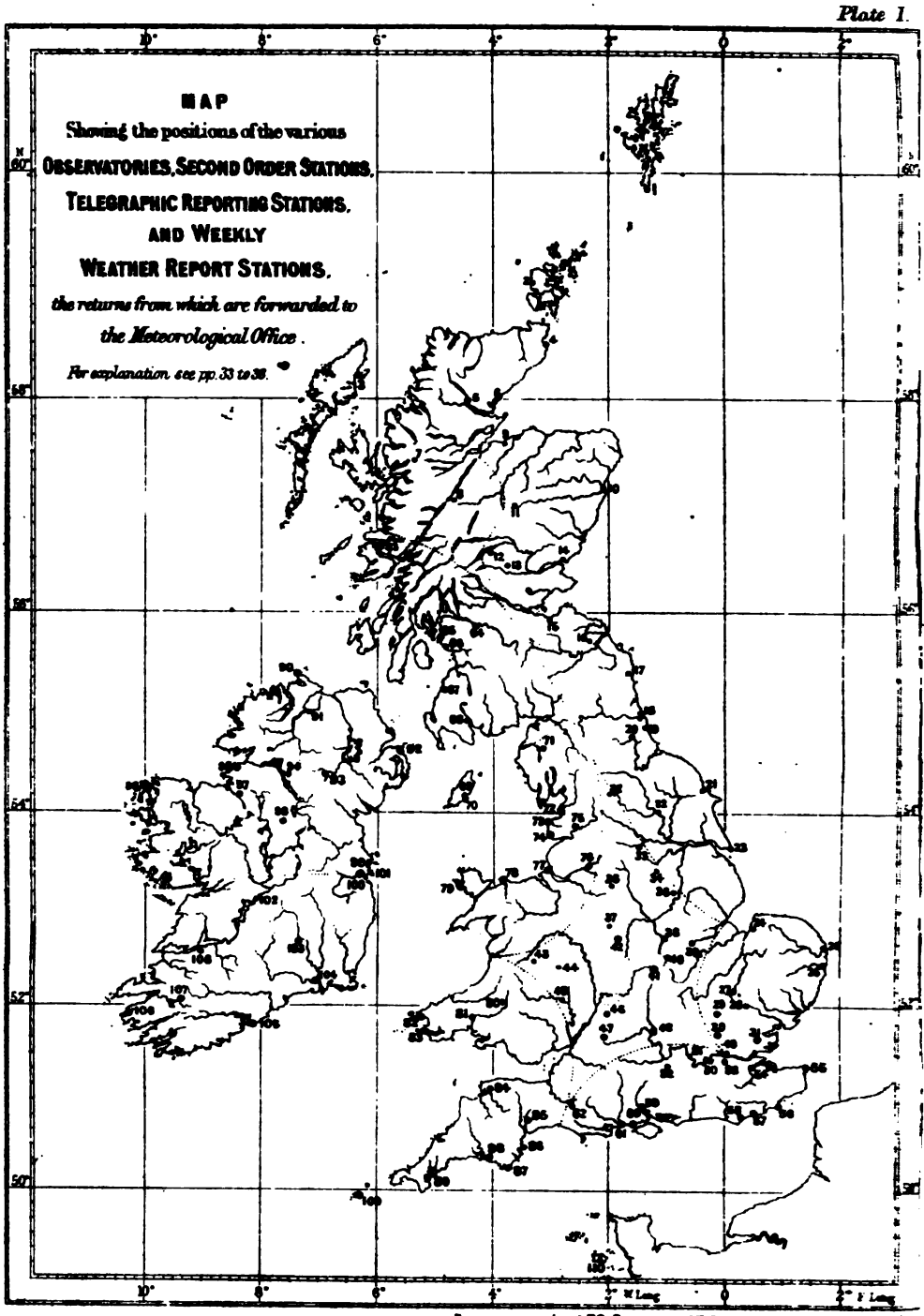
(v.) The one observation of the second series with saturated air gives a result 0·18 mm. smaller than the tabulated pressure, and thus with the 12 experiments of the first series confirms the results of Regnault's observations. To account for this, it is suggested that air which is very nearly or quite saturated, would deposit some of its moisture on the glass tubes used to conduct it from one vessel to another. This behaviour of nearly saturated air has been already noticed, and it is confirmed by the observations on dew-point instruments, and, moreover, by experiments directly intended for the purpose, quoted in a note.

Details are given of observations with Regnault's hygrometer and Dines's hygrometer when exposed in glass vessels between the saturator and the drying tube. The two instruments are separately discussed. With Regnault's instrument, after some practice, two different observers obtained practically identical results. In ordinary observations, the observed temperatures of the dew-point were below the temperature of saturation, but seldom by more than 0°·1 C. A considerable amount of uncertainty was shown to be attached to the readings, and by very close inspection readings of the dew-point were obtained above the temperature of saturation, in one case by as much as 0°·7 C.

From the experiments with Dines's hygrometer, it appears that the instrument is likely to give very easy determinations of the dew-point that are within small limits of error, but that if the instrument be observed with the closest attention, the result will be considerably too high, in consequence of the formation of a dew deposit at a temperature above the true dew-point, and it may possibly be erroneous in consequence of variations in temperature of the different parts of the box containing the thermometer.

An account is given of Alluard's modification of Regnault's hygrometer, and of Bogen's hygrometer.

A second note, B, is appended to the report, showing the tables used in various countries for the reduction of wet and dry-bulb observations.



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NOTE D.

TABLE giving the Names of the OBSERVATORIES, STATIONS of the SECOND ORDER, ANEMOMETER STATIONS, TELEGRAPHIC REPORTING STATIONS, and WEEKLY WEATHER REPORT STATIONS, in the BRITISH ISLANDS, OBSERVATIONS from which were forwarded to the METEOROLOGICAL OFFICE during the year 1887.

The Stations are grouped into the Meteorological Districts to which they belong, and arranged according to the numbering on the Map, Plate I.

References.—Column 3. Stations marked ℳ are in connexion with the Royal Meteorological Society.
" " " Stations marked 𝒮 are in connexion with the Scottish Meteorological Society.
" " 4. "Obs." = Observatory (first order); S.O. = Second Order Station; A. = Anemometer Station; T. = Telegraphic Reporting Station; W. = Weekly Weather Report Station.

District.	No. of Station on Map (see Plate I.).	Name of Station.	Class of Station.	Notes.
0. Scotland, North.	1	Sumburgh Head (Dunrossness).	T.; W.	
	2	Swanbister -	A.; S.O.	Sunshine recorder.
	3	Stornoway -	T.; W.	S.R. Aneroid and Sunshine recorder.
	4	Wick - -	T.; W.	
	5	𝒮 Lairg - -	W.	
	6	𝒮 Dunrobin -	S.O.	
	7	𝒮 Glen Carron -	W.	Sunshine recorder.
	8	𝒮 Fort Augustus -	W.	
1. Scotland, East.	9	Nairn - -	T.; W.	
	10	Aberdeen -	Obs.; T.	S.R. Aneroid and Sunshine recorder.
	11	𝒮 Braemar - -	S.O.; W.	Sunshine recorder.
	12	𝒮 Ochtertyre -	W.	
	13	Glenalmond -	S.O.	
	14	𝒮 Dundee - -	S.O.	
	15	Leith - -	T.; W.	
	16	𝒮 Marchmont -	W.	Sunshine recorder.
2. England, N.E.	17	Alnwick Castle -	A.; W.	
	18	N. Shields -	T.; W.	
	19	Seaham - -	S.O.	
	20	Durham - -	S.O.; W.	Sunshine recorder.
	21	ℳ Scarborough -	S.O.; W.	Sunshine recorder at Oswaldkirk.
	22	York - -	S.O.; T.; W.	Sunshine recorder.
	23	Spurn Head -	T.; W.	

District.	No. of Station on Map (see Plate I.).	Name of Station.	Class of Station.	Notes.
3. England, East.	24	Hillington	S.O.; W.	Sunshine recorder.
	25	Yarmouth	A.; T.; W.	S.R. Aneroid.
	26	Geldeston	S.O.; W.	Sunshine recorder.
	27	Cambridge	T.; W.	Do. do.
	28	Saffron Walden	S.O.	
	29	Bennington	S.O.	
	30	Rothamsted	S.O.; W.	
	31	Ingatestone	W.	Sunshine recorder.
4. Midland Counties.	32	Aysgarth	S.O.	
	33	Wakefield	S.O.	
	34	Sheffield	S.O.	
	35	Bawtry	W.	Sunshine recorder at Worksop.
	36	Buxton	S.O.	
	37	Cheadle	S.O.; W.	
	38	Loughborough	T.; W.	
	39	Uppingham	S.O.	
	40	Leicester	S.O.; W.	Sunshine recorder.
	41	Rugby	S.O.	
	42	Uttoxeter	S.O.	
	43	Churchstoke	S.O.; W.	Sunshine recorder.
	44	Stokesay	S.O.	
	45	Hereford	W.	
	46	Cheltenham	S.O.	
	47	Cirencester	W.	Sunshine recorder.
	48	Oxford	T.; W.	Do. do.
5. England, South.	49	London	T.; W.	S.R. Aneroid and Sunshine recorder.
	50	Kew	Obs.	Sunshine recorder.
	51	Cooper's Hill (Egham).	S.O.	
	52	Strathfield Turgiss	W.	
	53	Epsom	S.O.	
	54	Chatham	S.O.	
	55	Margate	S.O.	
	56	Dungeness	T.; W.	
	57	Hastings (St. Leonards).	S.O.; W.	Sunshine recorder.
	58	Eastbourne	S.O.	
	59	Southampton	S.O.; W.	Sunshine recorder.
	60	Hurst Castle	T.; W	
	61	Southbourne	S.O.	
	62	Stowell	W.	Sunshine recorder.
6. Scotland, West.	63	Laudale	S.O.; W.	
	64	Glasgow	Obs.; S.O.; W.	Sunshine recorder.
	65	Rothesay	S.O.	
	66	Ardrossan	T.; W.	
	67	Pinmore	S.O.	
	68	Glenlee	W.	
	69	Cronkbourne, Isle of Man.	S.O.; W.	Sunshine recorder.
	70	Douglas, Isle of Man.	S.O.	

District.	No. of Station on Map (see Plate I.).		Name of Station.	Class of Station.	Notes.
7. England, N.W.	71		Newton Reigny	S.O.; W.	Sunshine recorder.
	72		Barrow-in-Furness.	T.; W.	
	73		Fleetwood	A.	
	74	M	Blackpool	W.	Sunshine recorder.
	75		Stonyhurst	Obs.; S.O.; W.	Do. do.
	76		Manchester (Prestwich).	S.O.; W.	
	77		Liverpool (Bidston).	T.: W.	
	78	M	Llandudno	S.O.; W.	Sunshine recorder.
	79		Holyhead	A.; T.; W.	S.R. Aneroid.
8. England, S.W.	80		Llandovery	W.	
	81	M	Caermarthen	S.O.	
	82		St. David's	S.O.	
	83		St. Ann's Head, (Pembroke).	T.; W.	Sunshine recorder.
	84		Arlington	W.	
	85	M	Cullompton	W.	Sunshine recorder.
	86	M	Babbacombe	S.O.	
	87		Prawle Point	T.; W.	
	88		Plymouth	W.	Sunshine recorder.
	89		Falmouth	Obs.; W.	Do. do.
9. Ireland, North.	90		Malin Head	T.; W.	
	91		Londonderry	S.O.; W.	
	92		Donaghadee	T.; W.	
	93		Armagh	A.; S.O.; W.	Sunshine recorder.
	94		Brookeborough	S.O.; W.	
	95		Mullaghmore	T.; W.	
	96		Belmullet	T.; W.	
	97		Markree Castle	S.O.; W.	Sunshine recorder.
	98		Edgeworthstown	S.O.; W.	
	99		Dublin, Glasnevin	S.O.	
10. Ireland, South.	100		Dublin, Phœnix Park.	A.; S.O.	Sunshine recorder.
	101		Dublin City	S.O.; W.	
	102		Parsonstown (Birr Castle).	S.O.; T.; W.	Sunshine recorder.
	103		Kilkenny	W.	S.R. Aneroid.
	104		Waterford	W.	
	105		Roche's Point	T.; W.	
	106		Valencia	Obs.; T.; W.	S.R. Aneroid and Sunshine recorder.
	107	M	Killarney	S.O.; W.	
	108		Foynes	W.	
Channel Islands.	109		Scilly	A.; T.; W.	S.R. Aneroid.
	110		Jersey	T.; W.	Sunshine recorder.

TABLE giving the NAMES of the OBSERVATORIES, STATIONS of the SECOND ORDER, ANEMOMETER STATIONS, TELEGRAPHIC REPORTING STATIONS, and WEEKLY WEATHER REPORT STATIONS in the BRITISH ISLANDS, OBSERVATIONS from which were forwarded to the METEOROLOGICAL OFFICE during the year 1887. The Stations are arranged alphabetically.

Reference.—Column 1. Stations marked ℳ are in connexion with the Royal Meteorological Society.
" " " Stations marked ℒ are in connexion with the Scottish Meteorological Society.
" " 4. "Obs." = Observatory (first order); S.O. = Second Order Station; A. = Anemometer Station; T. = Telegraphic Reporting Station; W. = Weekly Weather Report Station.

Names of Stations.	No. on Map.	Class of Station.	Notes.
Aberdeen	10	Obs.; T.	S.R. Aneroid and Sunshine recorder.
Alnwick Castle	17	A.; W.	
Ardrossan	66	T.; W.	
Arlington	84	W.	
Armagh	93	A.; S.O.; W.	Sunshine recorder.
Aysgarth	32	S.O.	
ℳ Babbacombe	86	S.O.	
Barrow-in-Furness	72	T.; W.	
Bawtry	35	W.	Sunshine recorder at Worksop.
Belmullet	96	T.; W.	
ℳ Bennington	29	S.O.	
ℳ Blackpool	74	W.	Sunshine recorder.
ℒ Braemar	11	S.O.; W.	Do. do.
Brookeborough	94	S.O.; W.	
ℳ Buxton	36	S.O.	
ℳ Caermarthen	81	S.O.	
Cambridge	27	T.; W.	Sunshine recorder.
Chatham	54	S.O.	
ℳ Cheadle	37	S.O.; W.	
ℳ Cheltenham	46	S.O.	
ℳ Churchstoke	43	S.O.; W.	Sunshine recorder.
Cirencester	47	W.	Do. do.
Cooper's Hill (Egham)	81	S.O.	
Cronkbourne (Isle of Man)	69	S.O.; W.	Sunshine recorder.
ℳ Cullompton	85	W.	Do. do.
Donaghadee	92	T.; W.	
Douglas (Isle of Man)	70	S.O.	
Dublin, City	101	S.O.; W.	
ℒ Dundee	14	S.O.	
Dungeness	56	T.; W.	
ℒ Dunrobin	6	S.O.	
Durham	20	S.O.; W.	Sunshine recorder
Eastbourne	58	S.O.	
Edgeworthstown	98	S.O.; W.	
Epsom	53	S.O	

Names of Stations.	No. on Map.	Class of Station.	Notes.
Falmouth	89	Obs. ; W.	Sunshine recorder.
Fleetwood	73	A.	
Fort Augustus	8	W.	
Foynes	108	W.	
Geldeston	26	S.O. ; W.	Sunshine recorder.
Glasgow	64	Obs. ; S.O. ; W.	Do. do.
Glasnevin (Dublin)	99	S.O.	
Glenalmond	13	S.O.	
Glencarron	7	W.	Sunshine recorder.
Glenlee	68	W.	
Hastings (St. Leonards)	57	S.O. ; W.	Sunshine recorder.
Hereford	45	W.	
Hillington	24	S.O. ; W.	Sunshine recorder.
Holyhead	79	A. ; T. ; W.	S.R. Aneroid.
Hurst Castle	60	T. ; W.	
Ingatestone	31	W.	Sunshine recorder.
Jersey	110	T. ; W.	Sunshine recorder.
Kew	50	Obs.	Sunshine recorder.
Kilkenny	103	W.	S.R. Aneroid.
Killarney	107	S.O. ; W.	
Lairg	5	W.	
Laudale	63	S.O. ; W.	
Leicester	40	S.O. ; W.	Sunshine recorder.
Leith	15	T. ; W.	
Liverpool (Bidston)	77	T. ; W.	
Llandovery	80	W.	
Llandudno	78	S.O. ; W.	Sunshine recorder.
London	49	T. ; W.	S.R. Aneroid and Sunshine recorder.
Londonderry	91	S.O. ; W.	
Loughborough	38	T. ; W.	
Malin Head	90	T. ; W.	
Manchester (Prestwich)	76	S.O. ; W.	
Marchmont	16	W.	Sunshine recorder.
Margate	55	S.O.	
Markree	97	S.O. ; W.	Sunshine recorder.
Mullaghmore	95	T. ; W.	
Nairn	9	T. ; W.	
Newton Reigny	71	S.O. ; W.	Sunshine recorder.
Ochtertyre	12	W.	
Oxford	48	T. ; W.	Sunshine recorder.
Parsonstown (Birr Castle)	102	S.O. ; T. ; W.	Sunshine recorder.
Phœnix Park (Dublin)	100	A. ; S.O.	Do. do.
Pinmore	67	S.O.	
Plymouth	88	W.	Sunshine recorder.
Prawle Point	87	T. ; W.	
Roche's Point	105	T. ; W.	
Rothamsted	30	S.O. ; W.	
Rothesay	65	S.O.	
Rugby	41	S.O.	

Names of Stations.	No. on Map.	Class of Station.	Notes.
Saffron Walden	28	S.O.	
Scarborough	21	S.O.; W.	Sunshine recorder at Oswaldkirk.
Scilly	109	A.; T.; W.	S.R. Aneroid.
Seaham	19	S.O.	
Sheffield	34	S.O.	
Shields, N.	18	T.; W.	
Southampton	59	S.O.; W.	Sunshine recorder.
Southbourne	61	S.O.	
Spurn Head	23	T.; W.	
St. Ann's Head (Pembroke)	83	T.; W.	Sunshine recorder.
St. David's	82	S.O.	
Stokesay	44	S.O.	
Stonyhurst	75	Obs.; S.O.; W.	Sunshine recorder.
Stornoway	3	T.; W.	S.R. Aneroid and Sunshine recorder.
Stowell	62	W.	Sunshine recorder.
Strathfield Turgiss	52	W.	
Sumburgh Head (Dunrossness).	1	T.; W.	
Swanbister	2	A.; S.O.	Sunshine recorder.
Uppingham	39	S.O.	
Uttoxeter	42	S.O.	
Valencia	106	Obs; T.; W.	S.R. Aneroid and Sunshine recorder.
Wakefield	33	S.O.	
Waterford	104	W.	
Wick	4	T.; W.	
Yarmouth	25	A.; T.; W.	S.R. Aneroid.
York	22	S.O.; T.; W.	Sunshine recorder.

APPENDIX.

APPENDIX.

APPENDIX I.

LIST of CAPTAINS (and Officers) who have sent in Logs classed as "Excellent" during the year ending March 31, 1888. The figures opposite to each show the total number of such Logs which they have returned to the Office during the period that they have been observing.

Captain's Name.	Number of "Excellent" Logs.	Ship.
Adamson, A. W.	5	S.S. "Brindisi."
Alderton, T.	3	S.S. "Brindisi."
Aldrich, Pelham, R.N.	13	H.M.S. "Egeria."
Ashdown, Edward	1	S.S. "Brindisi."
Atkinson, S. P. H.	2	"Earl of Aberdeen."
Balfour, Lieut. Andrew, R.N.	21	H.M.S. "Rambler."
Baxter, A. S.	3	"City of York."
Becket, Alexander	9	"Amana."
Blacklin, R. J.	2	S.S. "Maryland."
Bright, H.	2	"Beltana."
Brown, E.	2	"Moorhill."
Cameron, H.	1	S.S. "Ardandhu."
Cameron, J. G.	1	S.S. "Adriatic."
Campbell, Hugh	6	"Bolan."
Campbell, James	6	"Saint Patrick."
Chaddock, G. A.	2	"Elissa."
Clapp, Staff Comr. E. S., R.N.	5	L.H. Tender "Richmond."
Clarke, James	9	S.S. "Olbers."
Cooke, C. F.	4	"Melbourne."
Crighton, A. T.	2	S.S. "Colina."
Cromarty, D. S.	1	"Cassandra."
Crutchley, W. C., R.N.R.	14	S.S. "Kaikoura."
Dark, Samuel	2	"Blairgowrie"
Dart, L. C.	8	"Alcester."
Davies, Joseph	3	S.S. "Flaxman."
Dawson, Comr. L. S., R.N.	5	H.M.S. "Sylvia."
Denham, George	9	S.S. "Ocean King."
Donaldson, J.	1	"Gareloch."
Douglas, Lt. H. H., R.N.	5	H.M.S. "Sylvia."
Draper, R.	5	S.S. "Monarch."
Dunbar, J. I.	11	S.S. "Arracan."
Ellery, William	17	"Talookdar."
England, Thomas	6	"Jane."
Ewan, John	1	S.S. "Kenmore."
Exham, T. K.	1	S.S. "Severn."

Captain's Name.	Number of "Excellent" Logs.	Ship.
Fraser, W. D.	2	"Thomas S. Stowe."
Fullarton, D.	3	"Timaru."
Gordon, James	13	S.S. "City of Agra."
Graham, W. V.	4	"Tenasserim."
Gray, David	14	S.S. "Eclipse."
Gray, John	11	S.S. "Hope."
Halley, Edward	3	"City of Madras."
Hepworth, C. M. W., R.N.R., F.R.Met. Soc.	6	S.S. "Port Pirie."
Hird, W.	3	"Marlborough."
Hood, William	1	"County of Edinburgh."
Hoskyn, Comr. R. F., R.N.	16	H.M.S. "Myrmidon."
Irving, P. J.	4	S.S. "Celtic."
James, George	2	"Middlesex."
Jones, Richard	1	"Thomas Hilyard."
Kemp, A. H.	1	"Hudson."
King, J. W.	2	"Philomene."
Lailey, W. N.	10	S.S. "Boyne."
Leportier, T.	6	S.S. "Mira."
Lyne, Lieut. W. O., R.N.	7	H.M.S. "Flying Fish."
Machugh, R. H.	2	S.S. "Ching Wo."
McLean, Archibald	4	S.S. "Concordia."
Maclear, J. F. L. P., R.N., F.R. Met. Soc.	18	H.M.S. "Flying Fish."
Marshall, Frederick	3	"Berkshire."
Maxwell, Joseph	3	"Oamaru."
Mesnard, Thomas	6	"Sierra Miranda."
Millican, J. W.	1	"Myrtle Holme."
Milne, W. F.	5	S.S. "Esquimaux."
Milner, W. H.	2	S.S. "Severn" and S.S. "Solent."
Mitchell, John	1	"Cape Verde."
Moignard, Philip	2	"Astoria."
Molony, E. J.	6	"British Merchant."
Moore, W. U., R.N.	11	H.M.S. "Rambler."
North, W. G.	7	S.S. "Tiger."
Parry, Moses, F.R.Met.Soc.	11	S.S. "Prydain."
Parsell, Henry	13	S.S. "Adriatic."
Parson, G. F.	7	"Earnock."
Pearson, C. W.	27	S.S. "Strathleven."
Peebles, R.	11	"Tweedsdale."
Plater, H. R. F.	2	"Patriarch."
Price, J. H.	3	"Viola."
Prout, J. C.	6	"Cape St. Vincent."
Read, G. W., F.R.G.S.	1	S.S. "Auretta."
Ross, Alexander	3	"Berbice."
Ross, James	1	S.S. "Benalder."
Richardson, Mr. W. H.	1	S.S. "Auretta."
Rosseter, W. L.	10	"St. Kilda" and "British Nation."
Russell, C. J.	7	"Khyber."

Captain's Name.	Number of "Excellent" Logs.	Ship.
Sargent, A. H. - - -	3	"Glenlora."
Scott, William - -	19	"Commewyne."
Simpson, Alexander - -	7	S.S. "Australasian."
Smith, Lieut. F. B., R.N. -	6	H.M.S. "Myrmidon."
Spratly, W. - - -	10	S.S. "Mozart."
Sturdee, H. K. - -	8	L.H. Tender "Richmond."
Tancred, Sub.-Lt. J. C., R.N. -	2	H.M.S. "Egeria."
Thomson, A. S., F.R.Met.Soc.-	9	S.S. "Buccaneer."
Tomlin, P. S. - - -	3	S.S. "Ballaarat."
Travers, H. D. - -	5	S.S. "Tartar."
Trott, Samuel, F.R.Met.Soc. -	10	S.S. "Minia."
Trunks, H. - - -	2	"Aldborough."
Walker, Henry - -	9	S.S. "Cephalonia."
Waring, William - -	13	S.S. "Breconshire."
Wheaton, N. J. - -	7	"Eliza."

Names of observers deceased printed in italics.

List of Documents received from Ships.

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
[1] Adamson, A. W. -	S.S. Brindisi - -	2,143	P. & O. Steam Navigation Co., London.	London to Madras, Calcutta, Madras, Marseilles, and London, viâ Suez -	1887
[2] Alderton, T. -	,, - -	,,	,, ,, ,,	To and from Calcutta, viâ Suez -	1887–88
[3] Aldrich, Pelham, R.N.	Egeria - -	940	H.M.S. - - - -	Plymouth to Colombo, viâ Suez -	1886–87
[3] ,, ,,	,, - -	,,	,, - - - -	Surveying off south-east coast of Ceylon	1887
[4] ,, ,,	,, -	,,	,, - - - -	Surveying off Batticoloa, Trincomalee, Singapore, Batavia, Christmas Island, and Mauritius - - -	1887
Anderson, C. A. -	Amphitrite - -	1,708	Colin S. Caird, Greenock -	Cardiff to Hong Kong and Havre -	1886–87
[5] Anderson, F. -	S.S. Durham - -	1,466	Walter S. Bailey, Hull - -	To and from Lyttleton. London to Bremerhaven. Antwerp, Bordeaux, River Plate, Bremerhaven, and London - - - -	1880–81
Ashdown, Edward -	S.S. Brindisi - -	2,143	P. & O. Steam Navigation Co., London.	To and from China, viâ Suez - -	1887
Asquith, W. -	S.S. Deucalion -	1,374	Ocean S.S. Co., Liverpool -	,, ,, - -	1886
Atkinson, S. P. H. -	Earl of Aberdeen -	2,133	Earl Sailing Ship Line, Lim., London.	To Colombo, Diamond Island, Akyab and home - - - -	1886–87
[6] Babot, E. S. -	S.S. Kent - -	1,620	Money Wigram and Sons, Lim., London.	To and from Australia, viâ Suez -	1883
[7] ,, ,, -	S.S. Northumberland -	—	,, ,, ,,	To and from Wellington, viâ Cape. London to Bremen, Antwerp, Pauillac, Monte Video, Buenos Ayres, Monte Video, Bahia, Bremen, and London. London to Sydney, Melbourne, and home, viâ Cape -	1880–82
Balderston, R. J. -	Bactria - -	2,122	Sir Thomas Brocklebank, Bart., Liverpool.	To and from Calcutta - - -	1887
Batt, H. - -	S.S. Hector - -	1,590	Ocean S.S. Co., Liverpool -	To and from China, viâ Suez - -	1886

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
Baxter, A. S.	City of York	1,195	G. Smith and Son, Glasgow	Liverpool to Astoria and Queenstown	1887–88
Becket, Alexander	Amana	1,299	John Smith, Glasgow	London to Coquimbo, Honolulu, Portland (Oregon), and Queenstown	1886–87
Bigley, H. B.	S.S. Diomed	1,471	Ocean S.S. Co., Liverpool	To and from China, viâ Suez	1886
Blacklin, R. J.	S.S. Maryland	1,852	"Maryland" S.S. Co., Lim., London.	Swansea to Philadelphia, Baltimore, and London	1887
Bremner, A. W.	S.S. Ulysses	1,301	Ocean S.S. Co., Liverpool	To and from China, viâ Suez	1886
Bright, H.	Barque Beltana	741	A. Lang Elder, London	To and from Adelaide	1887–88
Brown, E.	Barque Moorhill	484	E. Brown, Liverpool	Newport to Buenos Ayres, Barbados, Galveston, and Havre	1887–88
Brown, R. J.	S.S. Titan	1,554	Ocean S.S. Co., Liverpool	To and from China, viâ Suez	1886
Butler, S. H.	S.S. Priam	1,402	„ „	To China, Madras, and home, viâ Suez	1885–86
[8] Callaghan, J. P.	S.S. Norfolk	—	Money Wigram and Sons Lim., London.	To Cape Town, New Zealand, China, New York, viâ Suez, and London. To Cape Town, New Zealand, China, and London, viâ Suez. To Cape Town, Australia, and home, viâ Suez	1880–82
Callaghan, M.	S.S. Comeragh	467	Waterford S.S. Co., Lim., Waterford.	Trading between Waterford, Liverpool, and Bristol	1887
„ „	„	„	„ „ „	„ „ „	1887
„ „	„	„	„ „ „	„ „ „	1887–88
Cameron, H.	S.S. Ardandhu	757	Ardan S.S. Co., Lim., Glasgow	To Havana, Guadaloupe, Gibraltar, Marseilles, Gibraltar, and Newport (Mon.)	1887
[9] Cameron, J. G.	S.S. Adriatic	2,458	Oceanic S. Nav. Co., Liverpool	Three voyages to and from New York	1887
„ „	S.S. Ionic	3,070	„ „ „	From London to New Zealand, viâ Cape, Rio Janeiro, and London. (3 voyages)	1884–86
Campbell, Archibald	S.S. Circassia	2,770	Barrow S.S. Co., London	Five voyages to and from New York	1886–87

List of Documents received from Ships.

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
[1] Adamson, A. W. -	S.S. Brindisi - -	2,143	P. & O. Steam Navigation Co., London.	London to Madras, Calcutta, Madras, Marseilles, and London, viâ Suez -	1887
[2] Alderton, T. -	„ - -	„	„ „ „	To and from Calcutta, viâ Suez -	1887–88
[3] Aldrich, Pelham, R.N.	Egeria - -	940	H.M.S. - - - -	Plymouth to Colombo, viâ Suez -	1886–87
[3] „ „	„ - -	„	„ - - - -	Surveying off south-east coast of Ceylon	1887
[4] „ „	„ -	„	„ - - - -	Surveying off Batticoloa, Trincomalee, Singapore, Batavia, Christmas Island, and Mauritius - - -	1887
Anderson, C. A. -	Amphitrite - -	1,708	Colin S. Caird, Greenock -	Cardiff to Hong Kong and Havre -	1886–87
[5] Anderson, F. -	S.S. Durham - -	1,466	Walter S. Bailey, Hull - -	To and from Lyttleton. London to Bremerhaven. Antwerp, Bordeaux, River Plate, Bremerhaven, and London - - - -	1880–81
Ashdown, Edward -	S.S. Brindisi - -	2,143	P. & O. Steam Navigation Co., London.	To and from China, viâ Suez - -	1887
Asquith, W. -	S.S. Deucalion -	1,374	Ocean S.S. Co., Liverpool -	„ „ - -	1886
Atkinson, S. P. H. -	Earl of Aberdeen -	2,133	Earl Sailing Ship Line, Lim., London.	To Colombo, Diamond Island, Akyab and home - - - -	1886–87
[6] Babot, E. S. -	S.S. Kent - -	1,620	Money Wigram and Sons, Lim., London.	To and from Australia, viâ Suez -	1883
[7] „ „ -	S.S. Northumberland -	—	„ „ „	To and from Wellington, viâ Cape. London to Bremen, Antwerp, Pauillac, Monte Video, Buenos Ayres, Monte Video, Bahia, Bremen, and London. London to Sydney, Melbourne, and home, viâ Cape -	1880–82
Balderston, R. J. -	Bactria - -	2,122	Sir Thomas Brocklebank, Bart., Liverpool.	To and from Calcutta - - -	1887
Batt, H. - -	S.S. Hector - -	1,590	Ocean S.S. Co., Liverpool -	To and from China, viâ Suez - -	1886

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
Baxter, A. S. -	City of York - -	1,195	G. Smith and Son, Glasgow -	Liverpool to Astoria and Queenstown -	1887–88
Becket, Alexander -	Amana - -	1,299	John Smith, Glasgow - -	London to Coquimbo, Honolulu, Portland (Oregon), and Queenstown -	1886–87
Bigley, H. B. -	S.S. Diomed - -	1,471	Ocean S.S. Co., Liverpool -	To and from China, viâ Suez - -	1886
Blacklin, R. J. -	S.S. Maryland -	1,852	"Maryland" S.S. Co., Lim., London.	Swansea to Philadelphia, Baltimore, and London - - - -	1887
Bremner, A. W. -	S.S. Ulysses - -	1,301	Ocean S.S. Co., Liverpool -	To and from China, viâ Suez - -	1886
Bright, H. - -	Barque Beltana -	741	A. Lang Elder, London - -	To and from Adelaide - -	1887–88
Brown, E. - -	Barque Moorhill -	484	E. Brown, Liverpool - -	Newport to Buenos Ayres, Barbados, Galveston, and Havre - -	1887–88
Brown, R. J. -	S.S. Titan - -	1,554	Ocean S.S. Co., Liverpool -	To and from China, viâ Suez - -	1886
Butler, S. H. -	S.S. Priam - -	1,402	„ „ -	To China, Madras, and home, viâ Suez	1885–86
[8] Callaghan, J. P. -	S.S. Norfolk - -	—	Money Wigram and Sons Lim., London.	To Cape Town, New Zealand, China, New York, viâ Suez, and London. To Cape Town, New Zealand, China, and London, viâ Suez. To Cape Town, Australia, and home, viâ Suez	1880–82
Callaghan, M. -	S.S. Comeragh -	467	Waterford S.S. Co., Lim., Waterford.	Trading between Waterford, Liverpool, and Bristol - - - -	1887
„ „ -	„ -	„	„ „ „	„ „ „	1887
„ „ -	„ -	„	„ „ „	„ „ „	1887–88
Cameron, H. -	S.S. Ardandhu -	757	Ardan S.S. Co., Lim., Glasgow -	To Havana, Guadaloupe, Gibraltar, Marseilles, Gibraltar, and Newport (Mon.) - - - -	1887
[9] Cameron, J. G. -	S.S. Adriatic - -	2,458	Oceanic S. Nav. Co., Liverpool -	Three voyages to and from New York -	1887
„ „ -	S.S. Ionic - -	3,070	„ „ „ -	From London to New Zealand, viâ Cape, Rio Janeiro, and London. (3 voyages) - - - -	1884–86
Campbell, Archibald	S.S. Circassia - -	2,770	Barrow S.S. Co., London -	Five voyages to and from New York -	1886–87

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
Campbell, Archibald	S.S. Circassia	4,272	Barrow S.S. Co., London	Five voyages to and from New York	1887
Campbell, Hugh	Bolan	1,999	Sir Thomas Brocklebank, Bart., Liverpool.	Liverpool to Calcutta, and back	1887
Campbell, James	Saint Patrick	992	"Saint Patrick" Shipowning Co., Lim., Liverpool.	Maryport to Cooktown, Phœnix Islands, Samoa, and Plymouth.	1886–87
Campbell, R.	S.S. Lufra	1,134	Robert Ropner, West Hartlepool	Cardiff to Alexandria, Odessa, and home	1887
Chaddock, G. A.	Barque Elissa	409	H. F. Watt, Liverpool	Pensacola to Rosario, and towards Mauritius	1886–87
Chrimes, Henry	S.S. Sarpedon	1,592	Ocean S.S. Co., Liverpool	To and from China, viâ Suez	1886
[10] Clapp, Staff-Comr. E. S., R.N.	Schooner Richmond	183	Board of Trade, London	At the Bahamas	1886–87
" "	" "	"	" "	" "	1887
Clarke, James	S.S. Olbers	2,168	Liverpool, Brazil, and River Plate S. Nav. Co., Liverpool.	Two voyages from Liverpool to Lisbon, Bahia, Rio Janeiro, and home	1887
" "	"	"	" " "	Two voyages from Southampton, to Monte Video, Rio Janeiro, and Southampton	1887–88
[11] Conby, H. B.	Gilcruix	2,239	North-Western Shipping Co., Lim., Liverpool.	Liverpool to Melbourne, Calcutta, and London	1886–87
Cooke, C. F.	Melbourne	1,867	Joseph Moore, junr., London	London to Melbourne and back, viâ Cape of Good Hope	1886–87
Couper, William	Clackmannanshire	1 482	James and William Law, Glasgow	From Cardiff to Rangoon and Bremerhaven	1886–87
Crighton, A. T.	S.S. Colina	2,001	Donaldson Bros., Glasgow	To Monte Video, Barbadoes, Baltimore, and Glasgow. To and from Quebec	1886–87
Cromarty, D. S.	Barque Cassandra	711	J. Steel and Son, Liverpool	To and from New Zealand	1886–87
Crutchley, W. C., R.N.R.	S.S. Kaikoura	2,885	New Zealand Shipping Co., Christchurch, N.Z.	London to Cape Town, Hobart, Wellington, Rio Janeiro, and Plymouth	1887

LIST of DOCUMENTS, &c.—*continued.*

	Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
12	Crutchley, W. C., R.N.R.	S.S. Kaikoura - -	2,885	New Zealand Shipping Co. Christchurch, N.Z.	Plymouth to Cape Town, New Zealand, Rio Janeiro, and home - -	1887
12	" " -	" - -	"	" " " -	Plymouth to Cape Town, Hobart, Lyttelton, Rio Janeiro, and Plymouth	1887–88
	Dark, Samuel -	Blairgowrie - -	1,550	G. W. Gray, Glasgow - -	To Port Darwin, Java, and Liverpool -	1886–87
	" " -	" - -	"	" " - -	Liverpool to Calcutta and Dundee -	1887–88
	Dart, L. C. - -	Alcester - -	1,597	R. C. Haws, Liverpool - -	To Madras, Rangoon, and home -	1886–87
	Davies, Joseph -	S.S. Flaxman -	1,418	Liverpool, Brazil, and River Plate S. Nav. Co., Lim., Liverpool.	Two voyages to River Plate; one to River Plate and Antwerp - -	1886–87
	Davison, H. -	S.S. Arabic - -	788	Oceanic Steam Nav. Co., Lim., Liverpool.	From Hong Kong to Manila, London, viâ Suez, and Liverpool - -	1885
	" " -	S.S. Gaelic - -	2,691	" " " -	From Cardiff to Hong Kong, viâ Cape	1885
13	Dawson, Comr. L. S., R.N.	Sylvia - - -	1,050	H.M.S. - - - -	In the Mediterranean - -	1887
13	" " -	" - - -	"	" - - - -	In the Mediterranean and Arabian Seas	1887
13	" " -	" - - -	"	" - - - -	Surveying in Red Sea, and thence to Malta - - - -	1887–88
	Denham, G. -	S.S. Ocean King -	1,606	W. Ross, Glasgow - -	Two voyages to and from Montreal, one from Swansea to New Orleans -	1887
	Docherty, Hugh -	Baron Colonsay -	1,632	John Neill, Greenock - -	Cardiff to Singapore and Queenstown -	1887–88
	Donaldson, J. -	Gareloch - -	1,177	P. Rintoul, Glasgow - -	Glasgow to Sydney, Newcastle (N.S.W.), Rangoon, and home - -	1886–87
11	Draper, R. - -	S.S. Monarch - -	2,072	H.M. Telegraph Ship - -	Off coasts of British Isles - -	1886–87
11	" " - -	" - -	"	" " - -	" " " - -	1887
14	" " - -	" - -	"	" " - -	" " " - -	1887–88
	Dulling, George -	S.S. Port Phillip -	1,732	The Anglo-Australian Steam Navigation Co., Lim., London.	From Middlesboro' to Bombay, Moulmein, Bombay, and Antwerp, viâ Suez - - - -	1886–87

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
[15] Dulling, George -	S.S. Port Phillip -	1,732	The Anglo-Australian Steam Navigation Co., Lim., London.	To Hobart, viâ Cape, Newcastle (N.S.W.), Singapore, and Hamburg, viâ Suez - - - -	1887
Dunbar, J. I. -	S.S. Arracan - -	1,856	British and Burmese Steam Navigation Co., Lim., Glasgow.	Liverpool to Rangoon and London, viâ Suez - - - - -	1887
" " -	" -	"	" " "	To and from Rangoon, viâ Suez -	1887
Edwards, T. T. -	S.S. Stentor - -	1,307	Ocean S.S. Co., Liverpool -	To and from China, viâ Suez - -	1885–86
Ellery, William -	Talookdar - -	2,053	T. and J. Brocklebank, Liverpool	To and from Calcutta - - -	1886–87
England, Thomas -	Barque Jane - -	636	James Sutherland, Liverpool -	From Miramichi to Glasson Dock. To and from Quebec. From Troon to Matanzas (Cuba) - - -	1886–87
Ewan, John -	S.S. Kenmore -	495	Albany Shipping Co., Lim., Dundee.	To and from ports in Denmark, Norway, Sweden, and Spain - - -	1886–87
[11] Exham, T. K. -	S.S. Severn - -	1,119	Royal Mail Steam Packet Co., London.	Southampton to West Indies and Havre - - - -	1887–88
[16] Field, A. M., R.N. -	Dart - - -	470	H.M.S. - - - -	Surveying off New Guinea and Townsville (Queensland) - - -	1885
[17] " "	" - - -	"	" - - - -	Surveying off New Guinea and Townsville (Queensland), and at Sydney -	1886–87
[17] " "	" - - -	"	" - - - -	Surveying off Tasmania, Townsville, Louisiade Archipelago (New Guinea), and Sydney - - - -	1887
Fisher, P. B. -	Barque Cawdor -	2,355	John Houston, Liverpool -	Penarth to Singapore, Bassein, and Queenstown - - - -	1886–87
Fordyce, William -	County of Haddington -	1,865	Robert Craig, Glasgow - -	Penarth to Bombay - - -	1886
Fraser, W. D. -	Barque Thomas S. Stowe	686	Alfred Horsfall, Liverpool -	To Rockhampton (Queensland), Vancouver Island, and home - -	1886–87
Fullarton, D. -	Timaru - -	1,306	Shaw, Savill, & Albion Co., Lim., London.	To and from Wellington - -	1886–87

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
[18] Gordon, James -	S.S. City of Agra -	2,133	G. Smith, Glasgow - -	To and from Calcutta, viâ Suez -	1887
[18] " " -	" -	"	" " - -	Liverpool to Calcutta and London, viâ Suez - - - -	1887–88
[11] Graham, W. V. -	Tenasserim - -	1,419	Thomas Brocklebank, Liverpool -	To and from Calcutta - - -	1887
Gray, David -	S.S. Eclipse - -	435	D. Gray, Peterhead - -	To and from Greenland - -	1887
Gray, John - -	S.S. Hope - -	450	R. Kidd, Peterhead - -	" " - -	1887
Grey, C., R.N.R. -	MacMillan - -	1,450	John MacMillan, junr., Dumbarton.	Cardiff to Monte Video. Melbourne to Valparaiso - - - -	1885–87
[19] Griffin, E. J., R.N.R.	S.S. Moor - -	2,352	Union S.S. Co., Lim., London -	Plymouth to Cape Town and back -	1887
Halley, Edward -	City of Madras -	1,57	George Smith, Glasgow - -	Cardiff to San Francisco and Queenstown - - - -	1886–88
Hamilton, James -	Milton Park - -	1,461	Henry Grierson, Glasgow -	Glasgow to Sydney, San Francisco, and Queenstown - - - -	1885–86
Hannay, C. E. -	Prince Edward -	2,180	Robert B. Crowe, Liverpool -	Cardiff to Rio Janeiro, Chittagong, and Dundee - - - -	1886–87
[20] Hepworth, C. M. W., F.R. Met.Soc.	S.S. Port Pirie -	2,049	W. Milburn, London - -	From Plymouth to Cape Town, Adelaide, Newcastle (N.S.W.), Singapore, Calcutta, and London, viâ Suez -	1887
[20] " " -	" -	"	" " - -	To and from Adelaide, viâ Suez -	1887
Hinrichs, C. A. -	Barque Aline - -	718	James Grieve, jun., Greenock -	Glasgow to Brisbane, Newcastle (N.S.W.), Batavia, and Queenstown	1887–88
Hird, W. - -	Marlborough - -	1,124	John Leslie, London - -	To and from Otago - - -	1886–87
Hood, William -	County of Edinburgh -	2,078	Robert Craig, Glasgow - -	From Penarth to Bombay, Calcutta, and Hull - - - -	1886–87
Horne, James -	Loch Garry - -	1,493	John P. Kidston, Glasgow -	From Melbourne to London, viâ Cape Horn - - - -	1886–87
" " -	" - -	"	" " " -	Glasgow to Melbourne and London -	1887–88

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
[21] Hoskyn, Comr. R. F., R.N.	Myrmidon - -	877	H.M.S. - - - -	Surveying off Sydney, Melbourne, and Launceston, Tasmania - -	1886–87
[21] " " -	" - -	"	" - - - -	Surveying off Sydney and Townsville -	1887
[21] " " -	" - -	"	" - - - -	Surveying in Bass Straits, and at Sydney - - - -	1887
[22] Huddy, G. R. -	S.S. Durham - -	1,466	Walter S. Bailey, Hull - -	To Colombo, Batavia, Brisbane, Batavia, and home, viâ Suez. To Cape Town, Adelaide, Melbourne, Sydney, Hong Kong, Yokohama, Shanghai, New York, viâ Suez, and London -	1881–83
[23] " " -	S.S. Essex - -	1,675	Money Wigram, and Sons, Lim., London.	To and from Australia, viâ Suez. Viâ Suez to Australia, China, Japan, New York, Norfolk (Virginia), Liverpool, and London. - - -	1883–84
Hutchinson, J. -	S.S. Orestes - -	1,323	Ocean S.S. Co., Liverpool -	To and from China, viâ Suez - -	1886
[24] Irving, P. J. -	S.S. Celtic - -	2,439	Oceanic S. Nav. Co., Lim., Liverpool.	Six voyages to and from New York. (One voyage being on the S.S. "Republic") - - - -	1887
" " -	" -	"	" " "	Five voyages to and from New York -	1887–88
Jackson, Charles -	S.S. Palamed - -	1,536	Ocean S.S. Co., Liverpool -	To and from China, viâ Suez - -	1885–86
Jackson, M. H. F. -	S.S. Telamon - -	1,555	" " " -	" " - -	1886
Jackson, T. S. -	S.S. Palinurus - -	1,536	" " " -	" " - -	1886
Janes, George -	Middlesex - -	1,742	G. Marshall and Sons, London -	Cardiff to Singapore, Chittagong, and Dundee - - - -	1886–87
" " -	" - -	"	" " " -	" " " -	1887–88
Jennings, J. W. -	S.S. Doric - -	3,071	Oceanic S. Nav. Co., Lim., Liverpool.	To New Zealand, viâ Cape, Rio Janeiro, and London. (Two voyages) -	1885–86
Jones, Henry -	S.S. Telemachus -	1,421	Ocean S.S. Co., Liverpool -	To and from China, viâ Suez - -	1885–86

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
Jones, Richard	Thomas Hilyard	1,500	David V. Roberts, St. John, N.B.	Liverpool to New York, Sydney, Newcastle (N.S.W.), Manila, New York, and Liverpool	1886–88
Kemp, A. H.	Hudson	797	Shaw, Savill, and Albion Co., Lim., London.	To and from Wellington (N.Z.)	1886–87
Kidley, W. H.	S.S. Coptic	2,857	Oceanic S. Nav. Co., Lim., Liverpool.	From Wellington to Rio Janeiro and London. To New Zealand, Rio Janeiro, and Teneriffe. To New Zealand, viâ Cape Good Hope, and thence to London, viâ Cape Horn	1884–86
King, J. W.	Philomene	1,423	D. Fernie, Liverpool	Cardiff to Rangoon and Queenstown	1886–87
Lailey, W. N.	S.S. Boyne	1,306	Mercantile S.S. Co., Lim., London	Cardiff to Alexandria and London. Swansea to Alexandria, Odessa, and Rotterdam. Cardiff to Singapore, viâ Suez, and Rangoon	1886–87
„ „	„	„	„ „ „	Rangoon to Genoa, viâ Suez, and Cardiff. Cardiff to Massowah, Rangoon, and Alexandria, viâ Suez	1887
Lamb, Owen	Iron Cross	1,508	David Fernie, Liverpool	From Calcutta to New York	1887
Lapage, W. P.	S.S. Anchises	1,304	Ocean S.S. Co., Liverpool	To and from China, viâ Suez	1886
Leportier, T.	S.S. Mira	1,669	Star Navigation Co., Lim., Liverpool.	To and from Calcutta, viâ Suez	1887
„ „	„	„	„ „ „	„ „	1887
„ „	„	„	„ „ „	„ „	1887
„ „	„	„	„ „ „	Liverpool to Calcutta, and London, viâ Suez	1887–88

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
[25] Longley, H. -	S.S. Essex - -	1,675	Money Wigram & Sons, Lim., London.	Viâ Suez to Australia, China, Japan, New York, and London. To Australia, Bombay, and home, viâ Suez. To Hobart, Melbourne, Launceston, and Sydney, viâ Cape Good Hope, and thence, viâ Suez, to Antwerp and London - - - -	1885–87
[26] Lugar, W. R. -	S.S. Fee Chew -	643	William Keswick, London -	London to China, viâ Suez, and on China Coast - - -	1887
McGonnel, James -	Barque Matilda C. Smith	670	James McCausland, Belfast -	Ardrossan to St. Martinique, Pensacola, and Fleetwood - - -	1886–87
" " -	" " -	"	" " " -	Ardrossan to Martinique, Pensacola, and Fleetwood. Newport (Mon.) to Ponta Lara (Brazil), Pernambuco, and Liverpool - - -	1886–88
Machugh, R. H. -	S.S. Ching Wo -	1,556	China Shippers Mutual Stm. Nav. Co., London.	To and from China, viâ Suez - -	1887
" " -	" " -	"	" " " -	" " - -	1887–88
McLean, Archibald -	S.S. Concordia -	1,617	John Donaldson, Glasgow -	Four voyages to and from Montreal, &c. - - - - -	1886–87
" " -	" - -	"	" -	Five voyages to and from Montreal -	1887
[27] Maclear, J. F. L. P., R.N.	Flying Fish - -	940	H.M.S. - - - -	From Port Darwin to Christmas Island, Colombo - - - -	1886–87
[27] " " -	" - -	"	" - - - -	From Colombo to Portsmouth, viâ Suez	1887
McNeil, Ronald -	S.S. City of Agra -	2,133	G. Smith, Glasgow - -	To and from Calcutta, viâ Suez -	1887
Marshall, Frederick	Barque Berkshire -	1,472	George Marshall, London -	To Diamond Island and from Rangoon	1886–87
[28] Mathias, I. - -	Barque Hampshire -	1,164	Joseph Hossack, Liverpool -	To and from Melbourne - -	1882–83
Maxwell, Joseph -	Oamaru - -	1,306	Shaw, Savill, and Albion Co., Lim., London.	To and from New Zealand - -	1887

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
Meredith, John -	Brigantine Meg Merrilies - - -		- - - - -	From Suva (Fiji) to New Hanover and back - - - - -	1886–87
Mesnard, Thomas -	Sierra Miranda -	1,808	A. M. Anderson, Liverpool -	To and from Rangoon - - -	1886–87
Milburne, W. L. -	S.S. Ocean Prince - -	1,120	Prince Stm. Shipping Co., Lim., Newcastle-on-Tyne.	Barrow to Montreal and London. Liverpool to Galveston and back. Sunderland to Galveston - -	1887–88
[29] Miller, A. T., R.N. -	Conway - - -	- -	H.M.S. (Training Ship) - -	Off Birkenhead - - -	1887
Millican, J. W. -	Barque Myrtle Holme -	902	Wilfrid Hine, Maryport - -	To and from Melbourne - -	1886–87
Milligan, Samuel -	S.S. Jason -	1,412	Ocean S.S. Co., Liverpool -	To and from China, viâ Suez - -	1886
[29] Milne, W. F. -	S.S. Esquimaux -	466	Dundee Whale and Seal Fishing Co., Dundee.	To and from Davis Straits - -	1887
[11] Milner, W. H. -	S.S. Severn - -	1,119	Royal Mail Steam Packet Co., London.	Southampton to West Indies and Havre	1887
[30] ,, ,, -	S.S. Solent - -	1,206	,, ,, ,, -	In the West Indies - - -	1887
Mitchell, George -	S.S. Trinacria -	1,466	T. Henderson, Glasgow - -	Glasgow to Mediterranean Ports, New York, Mediterranean Ports, and Gibraltar - - - -	1887
[31] Mitchell, John -	Cape Verde - -	1,711	Alexander P. Lyle, Greenock -	From Cardiff to Singapore, Java, and Falmouth - - - -	1886–87
[32] Mitchell, W. H. -	S.S. Kent - -	1,620	Money Wigram and Sons, Lim., London.	Two voyages to and from Australia, viâ Suez. To Australia, Bombay, and London, viâ Suez. To Australia, viâ Cape, China, Japan, New York, viâ Suez, and London - - -	1884–87
Moignard, Philip -	Barque Astoria -	1,429	Peter Iredale, Liverpool - -	Glasgow to Melbourne, Portland (Oregon), and Falmouth - - -	1886–87
Molony, E. J. -	British Merchant -	1,696	British Shipowners' Co., Lim., Liverpool.	To San Francisco and Havre - -	1886–87

LIST of DOCUMENTS, &c.—*continued.*

	Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
[33]	Moore, Comr. W. U., R.N.	Rambler - -	835	H.M.S. - - - -	Surveying in China Seas - -	1887
[33]	" " -	" - -	"	" - - - -	" " - - -	1887
[33]	" " -	" - -	"	" - - - -	" " - - -	1887
	Nelson, Robert -	S.S. Menelaus - -	1,800	Ocean S.S. Co., Liverpool -	To and from China, viâ Suez - -	1886
	Nish, H. - -	S.S. Cyclops - -	1,403	" " -	" " - -	1886
	North, W. G. -	S.S. Tiger - -	510	Wilson and Sons, Hull - -	Trading between Hull and Hamburg -	1887
	" "	" - -	"	" " - -	" " -	1887
	" " -	" - -	"	" " - -	" " -	1887–88
[34]	O'Callaghan, J. P. -	S.S. Sussex - -	1,620	Money Wigram and Sons, Lim., London.	To and from Australia, viâ Suez. To Australia, viâ Suez, China, Japan, New York, viâ Suez, and London. To Australia, viâ Suez, Bombay, Naples, Cardiff, and London. To Australia, viâ Cape, and home, viâ Suez -	1883–87
[35]	Parke, R. H. -	Barque Hampshire -	1,164	Joseph Hossack, Liverpool -	Three voyages to and from Melbourne	1880–82
[36]	" "	S.S. Kent - -	1,620	Money Wigram and Sons, Lim., London.	To and from Australia, viâ Suez -	1883–84
	Parry, Moses, F.R. Met.Soc.	S.S. Prydain - -	1,252	Prydain S.S. Co., Lim., Nevin, Caernarvonshire.	Palermo to New York and Dublin. Cardiff to Malta, Palermo, Boston, and London. London to Boston and back - - - - -	1887
	Parsell, H. -	S.S. Adriatic - -	2,458	Oceanic S. Nav. Co., Lim., Liverpool.	Six voyages from, and five to, New York - - - - -	1886–87
[9]	" " - -	" - -	"	" " " " -	Three voyages to and from New York -	1887
[11]	Parson, G. F. -	Earnock - -	1,198	W. Fraser, London - -	Liverpool to Sydney and Rotterdam -	1887
	Pattman, Robert -	Barque Loch Torridon -	2,000	James Aitken, Glasgow - -	Cardiff to Bombay and Dunkirk -	1886–87

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
[37] Pearson, C. W.	S.S. Strathleven	2,436	W. Burrell, Glasgow	Glasgow to Japan, viâ Suez, China, New York, viâ Suez, and Gibraltar	1887–88
Peebles, R.	Barque Tweedsdale	1,403	John A. Roxburgh, Glasgow	Glasgow to Sydney, Newcastle (N.S.W.), San Francisco, and Hull	1886–87
[38] Perrin, T.	Barque Willowbank	811	Andrew Weir, Glasgow	Glasgow to Adelaide, Newcastle (N.S.W.), Valparaiso, Pisagua, and Falmouth	1885–87
Plater, H. R. F.	Patriarch	1,339	William Henderson, Aberdeen	To and from Sydney	1887–88
Price, J. H.	Barque Viola	595	C. T. Bowring, Liverpool	London to Vancouver Island, Iquique, and London	1886–88
Prout, J. C.	Cape St. Vincent	1,422	A. P. Lyle, Greenock	Cardiff to Basilon, Akyab, and Liverpool	1886–87
[39] Pullen, Lieut. and Comr. T. F., R.N.	Lark	—	H.M.S.	At Cooktown, New Guinea, and Sydney	1885–87
[40] Read, G. W., F.R.G.S.	S.S. Auretta	1,729	Auretta Steam Ship Co., Lim., London.	Cardiff to Bombay and Genoa, viâ Suez, Odessa, and Antwerp	1887
" "	"	"	Oriental S.S. Co., Lim., London	Cardiff to Kurrachi, Bimlipitam, Marseilles, viâ Suez, Odessa, and Hull	1887–88
Ritchie, Alexander	Four Winds	1,799	J. J. Gardiner, Liverpool	To and from Calcutta	1886–87
Ross, Alexander	Berbice	717	D. Kerr, Greenock	From Cardiff to Manilla	1886
Ross, James	S.S. Ben Alder	1,331	W. Thomson, jun., Leith	London to Japan, viâ Suez, New York, viâ Suez, and London	1886–87
[41] Ross, Sir J. C.	Erebus	—	H.M.S.	To Antarctic Regions	1839–43
Rosseter, W. L.	Barque British Nation	1,302	Samuel S. Parker, Liverpool	Calcutta to Trinidad, Barbados, and Demerara	1887
" "	" "	"	" "	From Demerara to Delaware, and Liverpool	1888
" "	Barque St. Kilda	865	A. T. Parker, Liverpool	Liverpool to Jamaica, and Calcutta	1886–87
Russell, C. J.	Khyber	1,967	Ralph Brocklebank, Liverpool	To and from Calcutta	1886–87

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
Sargent, A. H.	Barque Glenlora	774	Shaw, Savill, and Albion Co., Lim., London.	To and from Wellington	1887–88
Scott, William	Barque Commewyne	315	J. Grierson, Glasgow	Glasgow to Paramaribo, and London	1886–87
[42] Setton, William	Pleiades	997	Shaw, Savill, and Albion Co., Lim., London	To and from Otago, N.Z.	1886–87
Sheldrake, J. W.	Iron Cross	1,508	D. Fernie, Liverpool	New York to Calcutta	1886
Simpson, Alexander	S.S. Australasian	2,343	W. Henderson, Aberdeen	London to Melbourne, viâ Cape, Sydney, Mauritius, Bombay, and London, viâ Suez	1886–87
" "	"	"	" "	London to Melbourne, viâ Cape Town, and home, viâ Suez	1887
[28] Smith, J. H.	Worcester	—	H.M.S. (Training Ship)	Off Greenhithe	1886–87
Spratly, W.	S.S. Mozart	1,304	Liverpool, Brazil, and River Plate Steam Nav. Co., Liverpool.	From Buenos Ayres to Antwerp, and Liverpool. Liverpool to Monte Video and back. Liverpool to Monte Video, and Dunkirk	1886–87
Stewart, C.E., R.N.R.	S.S. Ceylon	1,277	Michael D. Lavin, Iver Heath, Bucks.	Two voyages to and from Norway and the Baltic	1887
Thearle, John	S.S. Lennox	1,327	John Warrack, Leith	From Liverpool to Penang, viâ Suez, China, Japan, New York, viâ Suez, and Glasgow	1887
Thompson, A.	S.S. Patroclus	2,386	Ocean S.S. Co., Liverpool	To and from China, viâ Suez	1886
Thomson, A. S.	S.S. Buccaneer	460	W. African Telegraph Co., London	Off West Coast of Africa, and home	1887
Thompson, J. S.	S.S. Nestor	1,269	Ocean S.S. Co., Liverpool	To and from China, viâ Suez	1886
[5] Ticehurst, R.	S.S. Essex	1,675	Money Wigram and Sons, Lim., London.	To Australia, viâ Cape, and home, viâ Suez. To Australia, Calcutta, and home, via Suez	1882–83
[43] Tomlin, P. S.	S.S. Ballaarat	2,679	P. & O. Steam Navigation Co., London.	To and from Melbourne, viâ Suez	1887

LIST of DOCUMENTS, &c.—*continued.*

	Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
	Townsend, W. -	Barque Birker - -	1,008	J. H. Busbby, London - -	London to Adelaide, San Francisco, and Dublin - - - -	1886–87
	" " -	Titania - -	- - -	- - - - -	From Bimlipitam to Hull - -	1885
	Travers, H. D. -	S.S. Tartar - -	2,755	Union S.S. Co., Lim., Southampton	Two voyages to and from Cape Town -	1886–87
	" " -	" - -	"	" " " -	Three voyages to and from Cape Town	1887
	" " -	" - -	"	" " " -	Two voyages to and from Cape Town -	1887–88
44	Trott, Samuel, F.R. Met.Soc.	S.S. Minia - -	1,350	Anglo-American Telegraph Co., London.	From Falmouth to Halifax and London, and cable laying in North Atlantic -	1887
44	" " -	" - -	"	" " " -	From Falmouth to Halifax, and at Halifax - - - -	1887
	Trunks, H. - -	Barque Aldborough -	1,425	British and Eastern Shipping Co., Lim., Liverpool.	Cardiff to Colombo, Rangoon, and Antwerp - - - -	1886–87
45	Wait, A. McLean, R.N.R.	S.S. Spartan - -	2,223	Union S.S. Co., Lim., Southampton	Two voyages to and from Cape Town, &c. - - - - -	1886–87
46	" " -	" - -	"	- " " " -	" " " " -	1887
47	" " -	" - -	"	" " " -	" " " " -	1887–88
	Walker, Henry -	S.S. Cephalonia -	3,490	Cunard S.S. Co., Lim., Liverpool	Six voyages to and from Boston -	188
	" " -	" -	"	" " " -	" " " -	1886–87
	Walker, W. H. -	S.S. Belgic - -	2,695	Oceanic Steam Nav. Co., Lim., Liverpool.	From Belfast to London. London to Sydney, via Cape, Newcastle (N.S.W.), and San Francisco - -	1885
48	Ward, J. -	Pegasus - -	2,564	T. C. Wilkinson, Liverpool -	Liverpool to Calcutta and back -	1886–87
	" " -	" - -	"	" " -	Liverpool to Calcutta and London -	1887–88
49	Waring, W. - -	S.S. Breconshire -	1,648	D. J. Jenkins, London - -	To and from China and Japan, via Suez - - - - -	1886–87
50	" " -	" -	"	" " -	" " " " -	1887
51	Watson, Alexander -	Barque Elvira -	464	Henry F. Watt, Liverpool -	To Hobart Town, and from Newcastle (N.S.W.), to Java and home -	1886–87
	Webster, J. K. -	S.S. Prometheus -	1,538	Ocean S.S Co., Liverpool -	To and from China, viâ Suez - -	1886

List of Documents, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
[52] West, Frederick -	S.S. Port Adelaide -	1,783	Anglo-Australian Steam Nav. Co., London.	London to Australia, viâ Cape, China, Japan, New York, viâ Suez, and Liverpool - - - -	1887–88
Wheaton, N. J. -	Barquentine Eliza -	299	J. H. Goodyear, Liverpool -	To Demerara, Barbados, and Nantes -	1887
,, ,, -	,, -	,,	,, ,, -	Liverpool to St. Domingo and Havre -	1887–88
Wilding, J. - -	S.S. Agamemnon -	1,523	Ocean S.S. Co., Liverpool -	To and from China, viâ Suez - -	1886
[53] Wilson, John -	S.S. Ethiopia - -	2,604	Barrow S.S. Co., Lim., Barrow -	Five voyages between Glasgow and New York - - - -	1886–87
[53] ,, ,, -	,, - -	,,	,, ,, ,,	,, ,, ,, -	1887
[54] Unknown - -	S.S. Somersetshire -	- - -	- - - - -	To and from Australia, viâ Cape of Good Hope - - - -	1880–81

In cases distinguished by marginal numbers the Meteorological Registers were kept chiefly by Officers, as follows:—

[1] Kept by R. A. Lindau, 3rd Officer.
[2] Kept by E. Simmons.
[3] Kept by Sub-Lieut. J. C. Tancred, R.N.
[4] Kept by Chen Ngen Tao, Lieut. I.C.N.
[5] Kept by H. C. Carr.
[6] Kept by F. T. Kimpton.
[7] Kept by G. T. Woods, Mate, and G. R. Huddy, Chief Officer.
[8] Kept by John Mathias.
[9] Kept by T. D. Blower, 3rd Officer.
[10] Kept by H. K. Sturdee.
[11] Assisted by Officers.
[12] Kept by J. L. Berryman, 4th Officer.
[13] Kept by Lieut. H. H. Douglas, R.N.
[14] Kept by C. J. Hall, 3rd Officer.
[15] Kept by O. W. Read.
[16] Kept by Lieut. W. P. Dawson, R.N.
[17] Kept by W. H. Jones.
[18] Assisted by Messrs. D. Morrison and W. R. More.
[19] Kept by J. E. Pierce, 4th Officer.
[20] Kept by Walter Newman, 2nd Officer, and other Officers.
[21] Kept by Lieut. F. Bowden Smith, R.N.
[22] Kept by H. C. Carr and J. Tracy.
[23] Kept by F. Johnson.
[24] Kept by John Christie.
[25] Kept by F. Johnson and A. H. Burgess.
[26] Kept by S. Stanton, 2nd Officer.
[27] Kept by Lieut. W. O. Lyne, R.N.
[28] Kept by the Boys.
[29] Kept by G. G. Tyson, Surgeon.
[30] Assisted by Messrs. Down, 2nd Officer, and G. Hunt, 4th Officer.
[31] Assisted by 1st and 3rd Officers.
[32] Kept by J. Prior and W. D. Stanney.
[33] Kept by Lieut. Andrew Balfour, R.N.
[34] Kept by B. Atkinson Finlay and J. Tracy.
[35] Kept by J. E. Fenton and F. Johnson.
[36] Kept by Joseph Prior.
[37] Assisted by A. Keith, 2nd Officer.
[38] Kept by J. Smith.
[39] Kept by Lieut. G. W. Gubbins, R.N.
[40] Kept by W. H. Richardson, 1st Mate.
[41] Observations by J. D. Hooker.
[42] Kept by Robert Findlay, Chief Officer.
[43] Kept by S. de B. Lockyer, 2nd Officer.
[44] Kept by Thomas C. Newton, F.R. Met. Soc., Chief Officer.
[45] Kept by V. E. Berg, 4th Officer.
[46] Kept by F. J. Kennedy, 4th Officer.
[47] Kept by F. I. Moseley.
[48] Kept by G. Leach, 2nd Mate.
[49] Assisted by J. H. Lashbrooke and G. W. Cundy, 2nd and 3rd Officers.
[50] Kept by J. H. Lashbrooke and E. N. Reed, 2nd and 3rd Officers.
[51] Assisted by Cecil Newby, Apprentice.
[52] Kept by D. E. Jamieson, 2nd Officer, and F. Williams, 3rd Officer.
[53] Kept by David Morgan, 3rd Officer.
[54] Kept by A. L. Paget.

APPENDIX III.

INSTRUMENTS supplied, &c. to the Royal Navy.

Per Account.	Barometers.	Aneroids.	Thermometers.				Hydrometers.
			Ordinary.	Max.	Min.	Screens.	
April 1st, 1887, afloat	190	413	1,312	224	182	141	118
Issued since	65	153	445	67	70	29	50
	255	566	1,757	291	252	170	168
Returned since	60	121	474	42	41	34	60
April 1st, 1888, afloat	195	445	1,283	249	211	136	108

INSTRUMENTS supplied, &c. for use at Naval Stations.

April 1st, 1887, in use	83	109	266	20	28	2	20
Issued since	4	4	37	2	8	1	1
	87	113	303	22	36	3	21
Returned since	20	29	64	17	11	1	3
April 1st, 1888, in use	67	84	239	5	25	2	18

DISPOSITION of ADMIRALTY INSTRUMENTS on April 1st, 1888.

Afloat in Royal Navy	195	445	1,283	249	211	136	108
In use at stations	67	84	239	5	25	2	18
In store at M.O.	90	73	129	38	59	30	50
„ Chatham	5	2	12	2	1	3	1
„ Sheerness	8	15	34	6	5	5	13
„ Portsmouth	4	13	14	6	5	17	8
„ Devonport	8	5	49	5	5	9	20
„ Queenstown	3	5	1	1	1	—	3
„ Gibraltar	1	3	14	—	—	—	4
„ Malta	5	8	16	7	6	—	17
„ Bombay	5	5	21	3	3	1	—
„ Halifax	4	10	26	5	6	—	14
„ Bermuda	3	10	—	2	4	—	15
„ Jamaica	3	3	19	2	2	—	—
„ Cape of Good Hope	5	7	31	10	5	3	30
„ Trincomalee	2	1	11	2	3	—	—
„ Hong Kong	8	12	46	15	14	2	12
„ Coquimbo	4	8	29	3	2	—	19
„ Sydney	3	2	10	4	3	—	—
„ Esquimalt	3	4	22	3	3	—	—
Total, April 1st, 1888	426	715	2,006	368	363	208	337
Lost, &c. since April 1st, 1887	13	31	358	34	25	20	21
Under repair	7	4	10	—	—	—	—

APPENDIX IV.

INSTRUMENTS supplied, &c. to Mercantile Marine.

Per Account.	Barometers.	Compasses.	Thermometers.				Hydrometers.
			Ordinary.	Max.	Min.	Screens.	
April 1st, 1887, afloat	138	—	790	—	1	141	420
Issued since	75	—	498	1	1	73	262
	213	—	1,288	1	2	214	682
Returned since	91	—	544	—	1	89	302
April 1st, 1888, afloat	122	—	744	1	1	125	380

INSTRUMENTS at Stations, viz., Telegraph Offices, Observatories, Fishing Villages, &c.

April 1st, 1887, in use	250	4	248	62	58	35	21
Issued since	14	—	50	8	8	8	—
	264	4	298	70	66	43	21
Returned since	10	1	31	13	6	7	8
April 1st, 1888, in use	254	3	267	57	60	36	13

DISPOSITION of Board of Trade Instruments on April 1st, 1888.

In merchant ships	122	—	744	1	1	125	380
In use at stations	254	3	267	57	60	36	13
In store at M.O.	32	1	121	5	32	33	120
At Liverpool Agency	6	7	24	—	—	8	22
„ Aberdeen „	6	—	45	—	1	5	24
„ Glasgow „	6	—	18	—	—	8	10
„ Dundee „	15	—	28	—	—	12	30
„ Hull „	7	—	36	—	—	8	26
„ Southampton „	3	—	20	—	—	6	23
„ Cardiff „	4	—	22	—	—	2	23
Total, April 1st, 1888	455	11	1,325	63	94	243	671
Lost, &c. since April 1st, 1887	5	1	149	4	2	37	93
At opticians	7	—	14	—	—	4	—

APPENDIX V.

List of Stations reporting Meteorological Observations to the Office by Telegraph on 31st March 1888, with the Names of Observers.

*†Sumburgh Head	Rev. W. Brand	Minister of Dunrossness.
*†Stornoway	J. Forbes	Nicolson Institution.
Wick	J. Sinclair	Watchmaker.
Nairn	Miss Penny	School mistress.
*†Aberdeen	J. McCormack§	Telegraph Clerk.
Leith	W. Hay	Do.
*†Shields	J. W. Irvine	Do.
Spurn Head	J. B. Smith	Assistant Lightkeeper.
†York	H. M. Platnauer, F.G.S.	Curator of Museum.
Loughboro'	W. Berridge, F.R.Met.Soc.	
†Ardrossan	J. W. Mayes	Telegraph Clerk.
Malin Head	J. O'D. Farren	Signalman, Lloyd's.
*†Mullaghmore	K. Kerr	Retired Coastguard Officer.
*†Belmullet	Miss M. J. Tolan	Telegraphist.
†Donaghadee	T. MacGowan	Postmaster.
Parsonstown	W. Harding	Assistant Observer at Lord Rosse's Observatory.
Barrow-in-Furness	W. S. Whitworth	Engineer, Barrow-in-Furness Railway.
*†Holyhead	Capt. Richards	Keeper of Sailors' Home.
Liverpool	J. Hartnup, F.R.Met.Soc.	Bidston Observatory.
*†Valencia	J. E. Cullum	Superintendent of the Observatory.
†Roche's Point	W. Kennedy	Telegraph Clerk.
Pembroke	S. Blake	Lightkeeper.
*†Scilly	W. Thomas	Signalman.
Prawle Point	W. Hewitt	Coastguard Officer.
†Hurst Castle	G. G. Appleton	Lightkeeper.
†Jersey	J. Fisher	Signalman.
*†Dungeness	P. Curnow	Lightkeeper.
*†London	F. Gaster, F.R.Met.Soc.	Clerk, Meteorological Office.
Oxford	W. Wickham	Radcliffe Observatory.
Cambridge	H. Todd	Observatory.
*†Yarmouth	G. T. Watson	Secretary, Sailors' Home.
‡Hawes Junction	W. H. Bunce	Station Master

Note.—Those stations marked with an asterisk (*) report also at 2h. p.m.; and those with a dagger (†) at 6h. p.m.

‡ This station now reports by post only.

§ Since dead. Mr. W. Boswell, of the Aberdeen Observatory, has been appointed observer in his stead.

APPENDIX VI.

Report of Inspection of the Irish Stations, with Holyhead.

Telegraphic Reporting Stations.

Holyhead, visited August 11.—The instruments at this station were clean and in good order. As regards the sand-glass anemometer, I think that the reason that the estimates for this station fall below those from Sumburgh Head and North Shields is to be found in the position of the Sailors' Home at Holyhead, on the slope of a small hill rising from the harbour. I have had a post for the reception of the instrument erected on Salt Island, close to the site of the bridled anemometer, and have directed Captain Richards to make a series of comparative observations in the two sites.

Belmullet, visited August 30.—I found nothing calling for remark at this station. The observer is rapidly learning to observe and report clouds accurately.

Roche's Point, visited September 9.—This station was in good order, as usual.

Valencia, visited September 14.—As regards the telegraphic observations there is nothing to report.

Parsonstown, visited September 19.—The observer at this station has been changed, but in all other respects no remarks are necessary.

Donaghadee, visited September 27.—This station is in good condition.

Malin Head, visited September 28.—The circumstances at this station are not satisfactory. The observer, J. O'D. Farren, at times hands over the work to an imperfectly trained assistant, and the Office can never be sure who is observing. The observer raises a difficulty about the 6 p.m. reports, inasmuch as the tower at which the barometer, &c. are placed is on a rocky hill, the descent of which after dark in winter is not easy.

Mullaghmore, visited September 30.—This station is, as usual, in good order.

Weekly Weather Report Stations.

Currygrane, visited September 2.—I found this station in good order. I am trying to induce Mr. Wilson, who has the requisite instruments, to institute readings at 9 p.m., so as to raise the station to the Second Order.

Killarney, visited September 13.—There is nothing to remark about this station.

Foynes, visited September 16.—The position of the instruments has been slightly changed, and they are all in good order.

Waterford, visited September 21.—This station continues fairly satisfactory.

Kilkenny, visited September 22.—There is nothing to remark about this station, except that the rain-gauge requires alteration, as it is of faulty construction.

STATIONS OF THE SECOND ORDER.

Dublin (*Fitzwilliam Square*), visited August 25.—This station is, as usual, in as good condition as is possible in the locality.

Dublin (*Glasnevin*), visited August 26.—I have nothing to remark about this station. The rainfall has during the first seven months of the year been exceptionally small, only 6·77 inches.

Dublin (*Mountjoy Observatory*), visited August 26.—The instruments were in very good order.

Markree, visited September 1.—This station also was in very good order. The mercury in the cistern of the Fortin's barometer is, however, much oxidised.

Parsonstown, visited September 19.—There is a change of observers at this station, and for the present Dr. Bœddicker is taking the observations. The regular observer has not yet been appointed.

Colebrooke, visited October 1.—This station does not call for remark.

Armagh Observatory, visited September 26.—The instruments are all in good condition. Dr. Dreyer has applied for a grass minimum and a solar radiation thermometer, which have been supplied.

(Signed) ROBERT H. SCOTT.

The following table shows the results of the thermometric comparisons:—

Corrections to be applied to the readings of—

STATIONS.	Dry Bulb.	Wet Bulb.	Max.	Min.	Spare Therm.	Remarks.
STATIONS OF THE SECOND ORDER.						
Armagh	+0·1	0·0	−0·7	—	—	
Brookborough	−0·9	−0·9	−0·4	−0·1	—	
Dublin (City)	−0·3	−0·2	−0·6	−0·1	—	Grass min. +0·1.
Dublin (Phœnix Park O.S.O.)	−0·5	−0·4	−0·6	+0·1	—	Do. +0·1.
Glasnevin	−0·1	−0·2	−0·7	+1·4	−0·2	Do. −0·1.
Londonderry	−0·3	−0·3	+0·3	+0·5	−0·1	
Markree Castle	−0·1	+0·1	0·0	+0·1	—	
Parsonstown	−0·4	+0·1	−0·3	0·0	—	
TELEGRAPHIC REPORTING STATIONS.						
Holyhead	+0·2	+0·1	0·0	+0·7	0·0	
Malin Head	−0·3	−0·2	−0·2	+0·5	−0·2	
Mullaghmore	−0·3	−0·2	−0·8	+0·2	−0·4	
Belmullet	−0·4	0·0	−0·2	−0·1	—	No spare thermometer.
Donaghadee	−0·2	−0·2	+0·3	+0·4	−0·1	
Parsonstown	+0·5	0·0	−0·2	−0·1	—	Do. do.
Valencia	−0·8	−0·6	−0·4	0·0	—	Do. do.
Roches Point	−0·7	−0·5	−0·8	−0·1	—	Do. do.
WEEKLY WEATHER REPORT STATIONS.*						
Edgeworthstown	−0·4	−0·3	−0·4	−0·6	−0·1	Grass min. +0·3.
Kilkenny	—	—	+0·1	0·0	—	
Waterford	−0·5	−0·4	−0·1	0·0	—	
Foynes	−0·3	−0·2	−0·1	+0·8	—	
Killarney	−0·6	−0·6	−0·4	−0·2	—	Screen is only single louvred.

* Observations from the dry and wet-bulb thermometers at these stations are not used in preparing the Weekly Weather Report.

Report of Inspection of the Scottish Stations for 1887.

Barometers.

The barometers at the stations were compared with inspector's mercurial standard barometer No. 532, except those at Pinmore and at Leith. The inspector's standard was accidentally broken on the journey from Glenlee to Pinmore, and consequently at the latter place the station barometer only was read. The barometer at Leith was compared with the Board of Trade barometer No. 958, which is one of the 12 barometers presented to the Scottish Meteorological Society in 1858 by the Board of Trade. It was compared with No. 532 on August 12 before setting out on the tour of inspection.

The results of the inspection are presented in the following table, which shows the "corrected" readings of the standard barometer and the uncorrected readings of the station barometers. The inspection shows that each of these important instruments remains in the excellent condition in which it was reported to be in 1885.

	Inspector's Standard, corrected.	Not corrected.		Remarks.
		Rep. Baro.	Check Baro.	
	ins.	ins.	ins.	
Nairn	29·834	29·832	29·832	
Stornoway	29·623	29·628	29·626	
Glenalmond	29·368	29·366	—	
Dundee	29·940	29·940	—	
Braemar	28·795	28·800	—	
Aberdeen	29·889	29·885	—	In Post Office.
Do.	29·785	—	29·780	In house, Braemar Place.
Swanbister	29·902	29·914	—	
Dunrossness	29·893	29·888	29·892	
Wick	30·050	30·050	—	In shop.
Do.	29·964	—	29·960	In house.
Dunrobin	30·032	30·036	—	
Laudale	29·477	29·476	29·458	Check barometer is 8 feet higher in flat above.
Rothesay	29·362	29·365	—	
Ardrossan	30·278	30·278	—	In Post Office.
Pinmore	—	29·475	—	Inspector's standard barometer broken.
Leith	30·296	30·290	—	In Post Office. Check barometer, see Inspector's Notes for Station.
King's College, Aberdeen	29·900	29·896	—	

In no instance did the difference between the inspector's readings and those of the observers or their assistants exceed 0·002 inch.

Thermometers.

The various thermometers at the stations were compared in water with the standard thermometer No. 2395, to the readings of which the following "corrections" were applied, viz., at 42°, −0°·4; at 52°, −0°·4; and at 62°, −0°·3. The table gives the "corrected" readings of the standard and the *errors* of each instrument as ascertained by the comparison. In all cases these errors closely correspond with those previously ascertained.

It is now rare to find any minimum thermometer out of order by showing a detached portion near the top of the tube. At Fort Augustus, 0°·4 was lodged at the top of the tube, but in such a way that it was not detected till after a comparison with the standard had been made. At Ardrossan the small portion separated from the rest of the spirit had been detected by the observer immediately before my visit, but he required a little instruction in the use of a small gas flame to restore it.

—	Standard No. 2,396, Corrected.	Dry Bulb.	Wet Bulb.	Spare Thermometer.	Max. Thermometer.	Min. Thermometer.	Time in Water in Minutes.	Change of Temperature.	Notes.
	°	°	°	°	°	°		°	
Nairn -	51·3	+0·6	+0·6	+0·1	−0·1	+1·0	75	+0·3	
Lairg - -	51·8	+0·1	+0·1	—	0·0	+0·1	90	Uniform	
Glencarron	48·7	+0·1	+0·2	—	+0·1	+0·1	60	Do.	
Stornoway -	52·4	+0·5	+0·5	+0·3	−0·4	−0·4	180	Do.	
Ochtertyre -	62·7	0·0	0·0	+0·5	+0·5	−0·1	150	Do.	
Glenalmond	60·1	+0·2	+0·3	—	+0·2	−0·1	120	Do.	
Dundee -	61·1	+0·4	+0·6	—	+1·4	−0·2	60	+0·2	
Braemar	55·3	+0·4	+0·5	—	+0·6	−0·1	150	+0·2	
Aberdeen -	57·1	+0·2	+0·5	—	+0·6	0·0	120	+0·3	
„ King's College.	57·2	+0·4	+0·3	—	+0·4	0·0	80	Uniform	In Stevenson's screen.
„ „	57·2	+0·1	+0·6	—	−0·2	−0·2	80	Do.	At Tower.
Swanbister -	57·9	+0·1	+0·1	—	0·0	−0·3	60	Do.	
Dunrossness	53·1	+0·4	+0·3	—	+0·3	−0·9	135	+0·3	
Wick - -	57·5	+0·3	+0·4	+0·4	−0·3	−0·2	60	Uniform	
Dunrobin -	61·8	−0·4	−0·6	—	+0·5	−0·5	70	+0·3	
Fort Augustus.	57·5	+0·1	+0·1	—	+0·1	−0·1	120	Uniform	
Laudale -	62·0	+0·2	+0·2	—	+0·2	+0·2	105	Do.	
Rothesay -	61·2	0·0	0·0	—	+0·1	−0·4	80	Do.	
Ardrossan -	57·2	+0·1	+0·1	—	−0·3	−0·5	60	+0·2	
Glenlee -	55·9	+0·3	+0·3	—	−0·2	+0·1	135	Uniform	
Pinmore -	50·9	+0·2	+0·4	—	0·0	+0·1	135	+0·3	
Leith - -	52·6	+0·1	+0·5	—	0·0	−0·5	60	Uniform	
Marchmont	50·8	−0·1	−0·2	—	+0·1	+0·1	140	+0·2	

Hygrometers.

Some attention was given during this inspection in preparing the following table with view of submitting to the Meteorological Council the data from which an idea may be formed as to the condition in which these instruments were found at the time of inspection.

—	Dry Bulb.	Wet Bulb.	Difference.	Hour of Reading.	Remarks on Weather.
	°	°	°		
Nairn - -	47·4	45·4	2·0	6 30 p.m.	Cloudy, with passing showers.
Lairg - -	53·9	46·2	7·7	3 0 „	Clear and dry.
Glencarron -	42·5	37·5	5·0	12 45 „	Sunshine and strong wind, with flying showers of rain, hail, and sleet.
Stornoway - -	—	—	—	—	New observer and position for station.
Ochtertyre - -	65·5	60·2	5·3	4 30 „	Sunshine, with occasional heavy showers.
Glenalmond -	63·6	55·0	8·6	1 0 „	Strong sunshine; breezy.
Dundee - -	69·8	61·2	8·6	2 0 „	Fine and bright.
Braemar - -	51·8	44·8	7·0	1 0 „	Sunshine, with occasional showers.
Aberdeen - -	54·3	52·1	2·2	7 35 „	Raining; overcast.
Do. King's College.	58·4	50·2	8·2	12 15 „	Fine and bright (in garden).
Do. do.	58·1	48·1	10·0	12 30 „	Do. (at tower).
Swanbister - -	54·1	51·7	2·4	9 40 a.m.	Dull and showery.
Dunrossness -	50·0	47·3	2·7	10 30 „	Slight drizzle, with blinks of sunshine.
Wick - -	55·5	53·9	1·6	4 30 p.m.	Dull and misty, but beginning to clear.
Dunrobin - -	58·4	55·8	2·6	11 45 a.m.	Sun breaking through mist.
Fort Augustus -	58·7	55·9	2·8	8 45 „	North wind, with mist.
Laudale - -	64·0	59·1	4·9	2 15 p.m.	Sunshine, with flying showers.
Rothesay - -	62·2	57·8	4·4	4 0 „	Half clouded, with occasional showers.
Ardrossan - -	55·7	51·2	4·5	8 20 a.m.	Clear and bright.
Glenlee - -	55·8	51·3	4·5	12 30 p.m.	Clearing after heavy rain.
Pinmore - -	60·0	52·2	7·8	1 40 „	Fine and breezy.
Leith - -	54·9	50·5	4·4	3 0 „	Overcast with haze.
Marchmont -	42·9	41·7	1·2	9 10 a.m.	A comparatively fair interval of 20 minutes during heavy rain of some hours' duration.

The instruments were all read in precisely the same way, viz., immediately on opening the thermometer screen ; the dry and wet bulbs were rapidly read, and a note was made at the same time of the state of the weather. In each case I was satisfied that the wet bulb was in good order, the observed differences being due to the different hours, and the hygrometric condition of the air at the time.

NOTES on the STATIONS.

Nairn, May 17.—The instruments were in very good order. Special attention was drawn to the errors referred to in the notes sent from the Meteorological Office, and the course to be systematically pursued in order to secure their non-repetition in future was explained at length. In about three weeks after my visit Miss Penny, who has been sometime assistant in a school near Banff, returns to be first assistant at Delnies School under Mrs. Penny, when the observations will be immediately under her charge. Each of the observers can read the instruments correctly, and make up a weather telegram with correctness and despatch.

Lairg, May 18.—The four thermometers now in use were quite recently compared at Kew, and the corrections are very trifling. The method of reading the new maximum thermometer, which was not understood, was explained and is now understood. The thermometer screen is to be placed on new posts, and arrangements made by Mr. Ross to prevent shaking of the maximum and minimum thermometers during high winds, which has probably been of occasional occurrence in the past. The minimum thermometer previously in use was found to have 2°·0 of spirit detached from the column. This instrument was correct when the station was inspected in September 1886. The observing instruments were all in good order.

Glencarron, May 19.—The instruments were in excellent order and read with much intelligence. This is a well-appointed station, possessing, in addition to the usual instruments, a barograph and a thermograph, the latter in a Stevenson's screen close to the other thermometers, and three snow gauges, of 5, 10, and 15 inches diameter respectively, which are read daily when snow has fallen. Glencarron is situated in the valley of the Carron, which is steep and narrow, mountains rising on all sides, some of them to heights exceeding 3,000 feet. The situation is absolutely open on all sides.

Stornoway, May 20 and 21.—I spent nearly the whole of Friday and Saturday in removing the instruments to their new positions at Nicholson Institution, and in seeing that Mr. Forbes, the new observer, was thoroughly prepared to serve as reporter. Mr. Forbes showed a remarkable readiness in reading the instruments and making up the daily telegrams, and gives good promise of being an excellent observer. Before I left, Miss Riddoch, his sister-in-law, read the thermometers and set the vernier correctly, and three weeks thereafter I was informed that she had learnt to read all the instruments and prepare the daily telegram.

Ochtertyre, July 13.—The instruments here are remarkably well kept and observed, and a duplicate set is kept. There is also a snow gauge. The grass plot where they are placed is on a slope facing the south, and is open to the sun nearly the whole day. The grounds are richly wooded with trees and shrubs, and are thus less open to the winds than is generally the case.

Glenalmond, July 14.—The instruments are well kept and carefully observed. Mr. Reid is assisted by Mr. Delius, master of foreign languages, with whose assistance every effort will be made to observe the 9 p.m. readings, but the engagements of both observers in the college will preclude anything like a continuous record being made at this hour.

Dundee, July 15.—The instruments were in very good order, and evidently are carefully attended to. The observations are made correctly and expertly. The wind estimations at the time of my visit were again made correctly.

Braemar, August 13.—The instruments were found to be in excellent order, and both Mr. Aitken and Miss Kelly, the assistant, are remarkably good observers.

Aberdeen, August 15.—The instruments were in excellent order, and the observations made intelligently and accurately. The thermometer screen had been painted a few days before my visit. An extreme reading of the barograph, showing the extreme value, highest or lowest, will in future be forwarded to the Office.

Swanbister, August 18.—The condition of the instruments and the methods of observing were such as to leave nothing to be desired. Mrs. Fortescue read the barometer and other instruments with exactness. The observations of the direction of the wind no doubt approximate closely to the direction for the district; if there be any deviation from this, it can be no more than a slight modification due to the low ridge, lying from N.W. to S.E., on which the anemometer is placed. This instrument appeared to be in very good order.

Dunrossness, August 20.—The instruments were in very good order, and the observations made carefully and correctly by the three observers. Miss Brand now makes up the daily telegram correctly and with tolerable despatch. Much attention has been given by Mr. Brand and assistants to observations of the force of the wind by the hand anemometer, and in every case, without exception, the estimated force is written down before the observation with the anemometer is made. So far as Mr. Brand remembers, every case of difference between the estimated and the observed force, amounting to three miles per hour or more, was explained by short-lived gusts, or temporary lulls, or diminished force during the revolutions of the anemometer.

Wick, August 23.—The instruments were in very good order, and intelligently observed. The thermometer screen had been painted a month before my visit, and was in very good condition. As regards the late arrival of the telegrams in London, Mr. and Miss Sinclair promise that every effort will be made to have them delivered at the post office not later than 8.30 a.m.

Dunrobin, August 24.—The instruments were in good condition, and the observations are made with care. The rain-gauge was slightly deformed, but was put right. Observations of wind-force will probably be commenced soon.

Fort Augustus, August 26.—A portion of spirit, equal to $0^{\circ}\cdot4$, was separated from the column of the minimum thermometer and lodged at the top of the tube. With the help of the observer it was put right. With this exception the instruments were in excellent order, and the observations made with much intelligence. The positions of the various instruments are remarkably good. The observations are made here at 8.45 instead of 9 o'clock, as the regulations of the Monastery preclude the observations being taken at the latter hour.

Laudale, August 29.—The instruments were in very good order, and well observed. The "weather initials" were carefully gone over, and will in future be strictly adhered to, and such observations as those of "frost" will be entered in the "Remarks" column. As regards the back schedules from January 1886, Mr. Fletcher will have them copied and transmitted as soon as possible.

Rothesay, August 30.—Everything at this station was in excellent order, and the observations are made with much care.

Ardrossan, September 8.—Before opening the thermometer screen, Mr. Mayes informed me that on the previous day he had observed a small portion of the spirit of the minimum thermometer detached, but had been unable to put it right. This proved to be 0°·6. It was put right in his presence, and partly with his assistance, by means of a small gas flame. The rain-gauge was slightly deformed, but was set right. Otherwise the instruments were in good order, and there is much interest and intelligence in the work of observing.

Glenlee, September 26.—The instruments were in very good order, and were correctly and intelligently observed. The height above mean sea level, determined from a B. M. a little way off, is 206 feet. The station is on a low, rather broadish ridge, between two streams which join the Ken near this place. It seems probable from the appearance of the district that W.N.W. winds will unduly preponderate over the winds immediately contiguous to them, but otherwise the winds will fairly represent the general direction for that part of Scotland.

Pinmore, September 29.—The instruments were all in particularly good order. The assistant observer has recently been engaged as apprentice gardener. At present he reads the thermometer correctly to whole degrees, and it is expected that he will soon be able to read all of them in the usual way. Mr. Donald had been called to Girvan the morning of my visit, where I saw him for half an hour on my way to Ayr.

Leith, October 5.—The instruments here are all well kept, and the observations accurately made. A ventilator was added to the thermometer screen since last inspection, and a new glass measure for the rain-gauge has been got. Mr. Hay's family removed in May to Hawthorn-bank Place, and the check barometer was found to be correct in its new position.

Marchmont, October 8.—The instruments are well placed and in excellent order, and the observations are carefully made. The sun shines on the thermometer box at all hours and seasons, except for about three weeks in the depth of winter, when they are shaded for a brief interval after sunrise by a clump of ash, birch, and sycamore trees about 100 yards off.

The Observatory, King's College, Aberdeen, August 15.—The attached thermometer of the standard barometer was found some time ago to have slipped down, and consequently reading too low. It was correct when compared with inspector's standard in 1885, but as I did not carry a barometer with me in 1886, there was no comparison that year. The accident had taken place some time after 1885. It would assist in detecting an error of this sort if the stems of the attached thermometer were always graduated, which is seldom the case. With this exception all the instruments were in excellent order, and excellently manipulated and observed.

(Signed) A. BUCHAN.

Report of Inspector of the English Stations, 1887.

Telegraphic Reporting Stations.

Dungeness, inspected June 18.—There continue to be occasional errors in the barometric reports from this station, due, as I think, to inaccuracy on the part of some of the observers. As I have previously reported, the readings are taken by the light-keepers in rotation as they are on duty. All the instruments were found to be in good order, and the thermometers read well together. The low temperatures occasionally reported from this station, as compared with temperatures reported from stations at no great distance on the coast, are, as I feel convinced, correct. The estimated wind-force in gales, as reported from this station, appears somewhat low; but I venture to question whether it is incorrect. I consider that there is a slight tendency at nearly all our inland and east coast stations to over-estimate the wind-force; and it may be observed in this connexion that the observer, Mr. P. Curnow, who is responsible for the wind reports at Dungeness, has spent the greater part of his life on the Cornish coast. The direction of the wind does not always seem to be reported with exact accuracy from this station. It was correctly estimated by the observers on the day of my visit; but I noticed what I have observed with surprise of light-keepers at many other localities, that they estimated with hesitation and inaccuracy the compass direction of various objects on the horizon. The reports from this useful station will, I think, improve.

Jersey, June 21–22.—The observer, Mr. Fisher, had recently been appointed station-master at the railway station of St. Aubins, and had therefore removed one of the barometers from his house at Noirmont to the booking office at the terminus. The thermometer screen was also removed from Noirmont to a small piece of ground adjoining the railway station, of which I have sent a plan to the Meteorological Office. The barometer now in use, No. 531, is that which was formerly used as the check barometer at Noirmont, the height of the cistern above mean sea level I estimate as 25 feet. I recommend that this barometer should be moved from the booking office into a waiting-room which is little used and is visible from the office. In its present position it will in winter be in too close proximity to a gas stove. No fire is ever lighted in the waiting-room. The 8 a.m. readings of the barometer were at the date of inspection still taken at Noirmont. The thermometer screen has a pretty fair exposure. The change of altitude will necessarily cause the summer maxima to be somewhat higher than those previously reported from Noirmont.

Hurst Point, June 24.—I found all the instruments at this station in excellent order, and the observer, Mr. Appleton, certainly improves to some extent in care and accuracy. It must, however, be admitted that as regards correctness in taking the bearings of distant objects, the remarks made for Dungeness apply to the observers here also. Sea disturbance can never be exactly estimated from this point.

Prawle Point, June 26.—A new observer, Mr. Hewitt, has been appointed at this station. He is a man of intelligence, and takes the observations with much accuracy; while his assistants, Mr. Mehegan, is (as mentioned in last year's report) a very efficient observer. All the instruments, excepting the minimum thermometer, were in excellent order. The minimum, No. 307, contained 0°·9 of detached spirit, and for the first time in my experience, I failed to restore this. I gave the

necessary instructions to the observer as to the method of doing this, and requested him in the meantime to make the necessary correction. The rain gauge had been torn away from its supports and partially injured a few days before my visit, during rainless weather, by the fall of one of the stays of the flagstaff. I had this remedied during my visit. I think that the reports from this station, as regards wind, weather, and sea disturbance, are as good as can be obtained from any point on our south coast.

Scilly (*St. Mary's*), June 28 and 29.—The observations at this station continue to be well conducted, although the observer, Mr. Thomas, is somewhat aged. His son occasionally assists in taking observations, but my opinion is that a most efficient substitute will be found in Mr. Alfred Hicks (strongly recommended by Mr. Smith Dorrien), whom I carefully examined in the knowledge of meteorological instruments, and who at any time could undertake the work, should the health of Mr. Thomas break down.

The barometers and thermometers read fairly well together, but the maximum on this occasion read 0·6 too high. Since last year some more of the louvre work of the door of the screen has gone to pieces, and I ordered that the door should be taken off (being temporarily replaced by perforated canvas), and completely repaired; that the whole screen should be repainted, and the cap should be repaired. Repairs were also required for the block holding the rain-gauge, which I ordered to be done at once. The moisture conveyed by the atmosphere over these islands contains a remarkable amount of salt, one of the results of which is that the velocity-trace of the anemograph is frequently dim, especially about midnight, and the paper is blurred with a yellow tint.

I had undertaken to fix a new brush for the anemometer, but this had not arrived at the time of my visit.

It appears as though the estimated wind-forces reported from this station are, in the cases of strong breezes and gales, somewhat too high. It is impossible for me without carefully comparing the estimated forces with the anemographs to pronounce an opinion on this subject, but it is certain that the force of the wind in gales, as felt at Scilly, appears extraordinary to those who are not accustomed to it.

Loughborough, August 25.—I found all the instruments at this station in excellent order, and the observations are carried on, as usual, with the utmost accuracy.

Barrow-in-Furness, September 3.—The instruments at this station were in fairly good order. The higher wind-forces appear to be somewhat over estimated, but the observer's house has a very bleak exposure to Westerly winds. As regards the direction of the winds, I have previously called attention to the diversion of Southerly air currents on this coast as explained by orographical considerations. The barometer is in good order, yet the readings reported appear not uncommonly to be too low.

North Shields, September 6.—The observations at this station continue to be carefully carried on, and the instruments are in fairly good order, with the exception of the rain-gauge. The latter instrument is nearly worn out. The large anemometer, erected since the last inspection, on the Dockwray Square Lighthouse, works well, but the clock has not always been accurately regulated. The results of the comparisons between the estimated wind-forces and the indications of the small hand anemometer have been satisfactory at this station, but as the

latter observations have to be taken at some distance from the post office, the official duties of Mr. Irvine prevented his continuing them. I have asked Mr. J. Foster Spence to take for some time the readings of the hand anemometer on his lawn (which is the place at which they have hitherto been taken), independently of, but simultaneously with, the estimations taken by Mr. Irvine in Dockwray Square. The results will be sent to the Meteorological Office.

York, September 7 and 8.—Although the barometer readings from this station occasionally appear too high, the observer seems to read with complete accuracy, and I can find no fault with the barometer. The absence of reported strong winds or gales from this station is somewhat remarkable, but that gales are practically almost unknown in York is a statement confirmed, so far as my inquiries have gone, by independent evidence.

Cambridge, September 20.—The observer was absent at the time of my visit. All the instruments were in very good order. The wind-forces reported from this station are, I believe, still deduced from the readings of the anemometer, and the instrument is considerably sheltered by trees on all sides of the observatory, and to some extent by the dome of the observatory itself. It is, I think, partly in consequence of this fact that the wind-forces reported seem to be almost always too low. It is, however, quite possible that the mean velocity of the wind over this district may be actually low. Every careful observer who has studied the effects of wind on trees, &c. in localities apparently similar must have been struck by the magnitude of the difference in these effects, and by the difficulty of accounting for this magnitude.

Yarmouth, September 21.—The reports from this station continue to be good. The self-registering aneroid works well, but has not been adjusted as frequently as it ought to have been. The anemometer, barometers, and thermometers are all in good order.

Stations of the Second Order, and those supplying Weekly Reports only.

St. Leonard's.—I inspected this station on June 20th. All the instruments were found to be in good order, and to be thoroughly well attended to. Some imperfections were noted in the returns from this station in the winter and early spring of this year, and the later returns of this year are not very satisfactory. It is not possible to obtain the services of a deputy for the 9 p.m. observations, and the observer is now and then obliged in very cold weather, such as we experienced last winter, to omit these observations.

The sunshine recorder is well placed, and is most carefully attended to by the reservoir keeper.

Leicester, August 25.—The instruments at this station were in tolerably good order, with the exception of a new grass minimum, which has an error of $-4^{\circ}\cdot5$. The observer is by no means accurate in taking readings of the instruments, especially of the barometer, and I see no prospect of improvement. The error in the hygrometrical reductions was again pointed out to the observer.

Sheffield, August 26.—It will still be impossible to obtain 9 p.m. readings at this station, unless the Meteorological Council see fit to pay about 1*s.* a week to the gardener. Mr. Howarth already bears (as I understand) the expense of the Sunday observations. The observations are admirably conducted, although a certain number of errors occurred

during the absence of Mr. Howarth, the curator of the Museum, in the spring of this year. The outdoor instruments have been moved about 21 yards from their former position, owing to the completion of the Art Gallery. The exposure is good, but the screen is painted green.

Prestwich, August 26.—The observer, Dr. Clunn, being absent at the time of my visit, and having the keys of the outdoor instruments, I was unable to obtain access to the thermometer screen and rain-gauge. No comparisons, therefore, could be made. The barometer has been moved to the site which it occupied before 1885. The instrument is in good order. The returns from this station are now very good.

Douglas (*Prospect Hill*), August 31 and September 1.—A new site has been obtained for the thermometric observations at this station, on the grounds upon which stands the Roman Catholic Church of St. Mary's, at an elevation of a few feet above the previous position on the roof of the observer's house. Little exception can now be taken to the position of the thermometers, although the screen is by no means entirely unsheltered. The rain-gauge still occupied an undesirable position on the roof of Mr. Keig's house, and I recommended that it should be removed to a position which I have marked out for it on the lawn in which the screen is placed. At this spot its exposure will not be perfect, but will be, I think, more satisfactory than in its former situation. I have sent to the Office a plan of the locality of the outdoor instruments. The barometer, though not very incorrect, is not a good instrument. This station possesses conditions of permanence which will probably render it a valuable one, and both the observer and his son-in-law, who assists in taking the observations, are careful and painstaking.

Douglas (*Cronkbourne*), inspected September 1.—The returns from this station continue to be very complete, and I found all the instruments in good order. The observer, Mr. A. Moore, no longer resides in Cronkbourne, but visits the instruments daily, and his assistant takes the observations accurately.

Hawes Junction, September 5.—Since this station was last inspected there has been a change of observers, and the new railway station master, Mr. W. H. Bunce, appears to take the observations with great care and accuracy. All the instruments were in excellent condition, but the barometer, when corrected for index error, read (at 28·2) somewhat low.

Seaham, September 7.—Mr. Aird was ill at the date of my visit, and I was unable to have an interview with him. The readings of the outdoor instruments are taken at the Cemetery Grounds by Mr. Leith, who is a most acute and accurate observer. The instruments are all in good order, but in the hygrometrical results mistakes still occasionally occur.

Durham, September 7.—Mr. Carpenter was absent on the day of my visit. The temporary substitute took the readings of the instruments most accurately. Everything was in excellent order at this station, and the returns are very careful and complete. The grass minimum reads very low.

York, September 8.—The observations at this station are now very carefully taken, and the observer reads the instruments with great accuracy. It might perhaps be well if a new rain-gauge were supplied, as it is somewhat inconvenient to employ the same instrument for the 8 a.m. and 9 a.m. readings. I am still of opinion that the meagre report of bright sunshine from this station is due to an unusual amount of haze produced by smoke.

Bawtry, Hesley Hall, September 9.—Owing to the rebuilding of the observer's house, all the instruments have been shifted since the last inspection. The outdoor instruments have a very fair exposure on a lawn on the north-west side of the house. The barometer is extraordinarily sluggish, but I ascertained that it contained no air. I requested the observer to have a guard made for the cistern of the barometer, without which the instrument is sure to receive injury. The observations at this station are fairly good.

Market Rasen, September 10.—This is a new station, of which I have sent a scale plan. The instruments are thoroughly good, excepting that the maximum at all temperatures between 52 and 82 inclusive, reads about ·9 too high, whereas the correction hitherto applied is +·2. I have requested the observer to compare the thermometers in melting ice, and meanwhile to apply a correction of −·9. The rain-gauge has hitherto been situated in the vicarage gardens, where it is very seriously sheltered by the house. I marked out a new and good site for it on the observer's lawn. Mr. Jevons appears to me to be very careful and accurate, and I highly recommend the station. The country round is nearly level, but the land on which the town is situated slopes downward slightly towards the north.

Geldeston, September 27.—The observer was absent at the time of my visit. The returns from this station are most excellent. All the instruments were in admirable order, except that the thermograph, which had been sent to Paris for repairs, had been roughly treated in the custom-house on its return. I adjusted it as well as I could.

Ingatestone, September 22.—This new Weekly Weather Reporting Station is a very promising one. The outdoor instruments, of the site of which we have a photograph, are well exposed and in very good order. The cistern of the barometer is 246 feet above mean sea level. The ground slopes gently down towards the S.E. The district is somewhat thickly wooded, especially to the northward of the observer's house. The set of instruments comprises a Stevenson's screen, fully equipped with thermometers, a high mast with vane, an anemometer, rain gauges, a Jordan's sunshine recorder, and a grass minimum and grass maximum, together with a black bulb *in vacuo*.

Eastbourne, September 23.—This new station is a very good one indeed. The instruments, which are all of the best description, are situated in different parts of the town ; but the observer, who has had several years experience, attends to them most carefully. He has also, a good deputy. The barometer is in a Parade shelter close to the sea, and its cistern is 33 feet above mean sea level. The rain-gauge is situated on a triangular lawn at some distance from this place. It has a very fair exposure. The screen is on a public lawn near the Grand Hotel, and is perfectly exposed. The anemometer is upon a martello tower between this and the sea. The sunshine recorder is fixed on the highest part of the roof of the Grand Hotel. It required a slight

adjustment. It is sheltered for a short period at present at 3 p.m. by an iron rod. The probability that the observations will be permanently kept up is an important consideration in favour of this station.

Epsom, September 24.—There have been some errors in the readings of the instruments at this station, and occasionally in the reductions, but there is every prospect of improvement. It is desirable that the barometer should be moved to the observer's new rooms where the altitude of the cistern will be 12 feet above the present height. I think that strong winds have hitherto been somewhat over-estimated at this station.

(Signed) W. CLEMENT LEY.

Barometer and Thermometer Readings.

Name of Station. (The Names of the Telegraphic Reporting Stations are in *Italics*.)	Barometer: Difference of Reporting from Inspector's Barometer.	Barometer: Difference of Check from Inspector's Barometer.	Barometer: Difference of Observer's from Inspector's Readings.	Thermometer: Dry Bulb: Temperature in Water.	Dry Bulb: Correction to reduce to Inspector's Standard.	Dry Bulb: Correction hitherto applied.	Wet Bulb: Correction to reduce to Inspector's Standard.	Wet Bulb: Correction hitherto applied.	Maximum: Correction to reduce to Inspector's Standard.	Maximum: Correction hitherto applied.	Minimum: Correction to reduce to Inspector's Standard.	Minimum: Correction hitherto applied.	Spare or Grass: Correction to reduce to Inspector's Standard.	General Condition.	Name of Station.
Dungeness	+ ·002	·000	+ ·002	58·4	0·0	—	+0·1	—	0·0	—	−0·1	—	—	B	*Dungeness.*
St. Leonards	+ ·002	—	·000	65·9	−0·3	−0·4	−0·3	−0·4	+0·1	0·0	+0·1	0·0	—	A	St. Leonards.
Jersey	+ ·002	+ ·001	·000	61·2	0·0	0·0	−0·3	0·0	+0·1	0·0	+0·2	0·0	—	A	*Jersey.*
Hurst Point	+ ·003	+ ·001	·000	63	−0·1	0·0	0·0	0·0	0·0	0·0	+0·1	0·0	—	A	*Hurst Point.*
Prawle Point	− ·002	− ·003	− ·002	55	+0·1	0·0	0·0	0·0	−0·4	0·0	−1·1	0·0	−0·1	A	*Prawle Point.*
Scilly	− ·016	− ·014	− ·004	65·1	−0·1	0·0	+0·1	0·0	−0·6	0·0	+0·1	0·0	0·0	A	*Scilly.*
Leicester	—	—	− ·023	60·9	+ ·1	—	+ ·2	—	+ ·4	—	+ ·8	—	+5·5	B	Leicester.
Loughborough	—	—	·000	61·2	+ ·1	—	0·0	—	+ ·1	—	+ ·2	—	—	A	*Loughborough.*
Sheffield	—	—	− ·002	60·6	0·0	0·0	− ·1	− ·1	+ ·1	0·0	+ ·1	− ·1	—	A	Sheffield.
Prestwich	− ·005	—	—	—	—	− ·3	—	− ·2	—	− ·4	—	− ·2	—	A	Prestwich.
Douglas (Prospect Hill)	+ ·009	—	+ ·002	64·6	0·0	0·0	0·0	0·0	0·0	− ·3	+ ·4	− ·2	—	B	Douglas (Prospect Hill).
,, (Cronkbourne)	− ·003	—	+ ·002	59·7	− ·1	—	0·0	—	+ ·1	—	+ ·6	—	—	A	,, (Cronkbourne).
Barrow-in-Furness	− ·006	—	0·0	60·8	− ·3	− ·4	− ·3	− ·3	− ·1	− ·1	0·0	− ·1	—	A	*Barrow-in-Furness.*
Hawes Junction	+ ·004	—	0·0	52·9	0·0	—	− ·1	—	0·0	—	0·0	—	0·0	A	Hawes Junction.
North Shields	− ·015	− ·001	0·0	58·6	+ ·8	—	+ ·5	—	0·0	—	+1·6	—	+ ·6	A	*North Shields.*
Seaham	—	—	—	55·5	+ ·1	—	− ·1	—	+ ·7	—	+ ·6	—	—	A	Seaham.
Durham	—	—	0·0	53·4	0·0	—	+ ·1	—	+ ·1	—	+ ·6	+ ·4	+1·1	A	Durham.
York	0·0	—	0·0	57·1	+ ·1	—	+ ·1	—	+ ·3	—	+1·2	—	—	A	York.
York	0·0	—	0·0	57·1	+ ·1	—	+ ·1	—	+ ·1	—	+1·0	—	—	A	*York.*
Bawtry	—	—	—	56·1	+ ·6	—	0·0	—	0·0	—	+ ·2	—	—	A	Bawtry.
Market Rasen	− ·011	—	0·0	54·9	−0·0	− ·1	0·0	− ·1	− ·9	+ ·2	+ ·1	—	− ·1	A	Market Rasen.
Cambridge	+ ·003	—	—	53·4	0·0	—	−0·1	—	− ·2	—	0·0	—	—	A	*Cambridge.*
Yarmouth	+ ·013	− ·004	+ ·001	57·5	0·3	—	+0·1	—	0·0	—	+0·3	—	—	A	*Yarmouth.*
Geldeston	·000	—	—	56·4	+0·0	0·0	−0·1	−0·1	0·0	−0·3	+0·1	−0·1	—	A	Geldeston.
Ingatestone	− ·016	—	·000	58·3	0·0	0·0	0·0	0·0	0·0	0·0	+0·4	+0·4	+0·2	A	Ingatestone.
Eastbourne	− ·016	—	− ·001	56·3	0·0	0·0	+0·1	0·0	+ ·1	0·0	+ ·1	0·0	—	A	Eastbourne.
Epsom	+ ·001	—	·000	55·0	0·0	− ·1	+0·1	0·0	+ ·2	0·0	0·0	0·0	—	B	Epsom.

REPORTS ON INSPECTIONS of OBSERVATORIES, 1887.

Falmouth Observatory, visited August 24.—The instruments at this observatory were found in good order, the lenses and fittings of both barograph and thermograph being cleaned and the clocks oiled.

The attached thermometer of the standard barometer was found to be properly fitted, and to have its graduations engraved upon its stem, but owing to its having risen through age, a correction of $-0^{\circ}\cdot6$ is now requisite to be applied to its scale readings.

The wet-bulb thermometers were all in good order, clean muslin and threads having been recently fitted.

The following corrections were determined at temperature of 66°:—

Dry standard No. 383, $-0^{\circ}\cdot7$; wet No. 388, $-0^{\circ}\cdot4$.

Maximum M.O. 104, $-0^{\circ}\cdot3$; minimum M.O. 308, $-0^{\circ}\cdot1$.

Notes were also made of the zero values both for summer and winter temperatures.

The anemograph was dismounted temporarily and thoroughly cleaned; the orientation showed an irregularity in the working of the direction pencil. This was found to be due to the shaft having split asunder at the clamping piece, and was rectified by having a brass collar soldered on, and filing the shaft down a little. My attention was called to an error in the adjustment of the pricker, by which means the setting of the instrument differed by some minutes from the times as indicated by the curves on the paper; this defect was rectified by packing the fitting piece of the pricker up with a morsel of paper, and instructions were given to the assistant to press the teeth of the cylinder into proper gear when starting the instrument, as the amount of backleash is rather large.

A close examination was made of the different rain-gauges, and squeezes made of the funnels. The exposure of all three is good on all sides, there being no trees or shrubs near to exert an injurious effect; the only possible sources of difference are, that the slightly broader edge of the funnel of the Beckley may cause splashing, and the allowance for incomplete discharge of the siphon made in tabulating may be somewhat inadequate.

The pencil used now is an ordinary lead pencil, a holder of larger size than usual having been fitted; the spring, however, appeared to be pressing harder upon the paper than was desirable.

Necessary instructions were given to Mr. Kitto to make certain alterations in his tabulations in accordance with memoranda supplied in the inspection notes handed me.

Valencia Observatory, visited September 5–10.—The photography at this observatory has been very unsatisfactory during the summer, on account of the inadequate water supply caused by the drought, and also to its very impure quality. The stock of waxed paper at the observatory is now approaching exhaustion, and Mr. Cullum hopes to be permitted to make use of A. G. B. paper after it is all expended. I gave certain instructions as to fitting up ruby blinds and employing ruby lanterns in the photographic work if the new process is adopted, as the present appliances are inadequate for working with a more sensitive medium than that at present in use. Meanwhile the results obtained are somewhat better than those got some months back.

A serious difficulty with the new paper will be the exclusion of light from the thermograph traces, the blackening varnish having greatly decayed on the thermometer stems. I took down both thermometers and tried to remove the old paint and apply new, but was unable for

want of materials to perform the operation satisfactorily. I, however, instructed Mr. Cullum in the method of performing the various processes, so that on the proper solvent, varnish, brush, and paint being forwarded to Valencia, he will be able to do what is necessary himself.

At the time of dismounting the wet-bulb thermometer, I carefully examined the tube at the point where the definition of the curve is defective, but found the tube so roughened by the abrasion previously reported that nothing can be done to rectify the defect.

The metal fittings of the instrument have corroded a good deal, and the upper band of the wet-bulb standard is broken quite away. I temporarily secured it by a wire binding.

The corrections to the thermometers were found to be at 60° :—

Dry-bulb standard K. S. 399, $-0°\cdot8$; wet-bulb standard K. S. 398, $-0°\cdot6$.

Maximum M. O. 1,003, $-0°\cdot0$; minimum, 2,497, $-0°\cdot3$.

The minimum figure scale differs nearly 1° from the graduations on the tube.

The wet-bulbs were found kept in good order, but the lamp-wicks are much discoloured from corrosion derived from the copper water-tank.

The barograph was dismounted and cleaned, and the air-tube in the cistern found to have the plug slightly corroded; this was removed, and the air-hole cleared by means of a knitting needle. The tube of the standard barometer is also much corroded, and the bands holding the attached thermometer were broken away. The tube, which is not divided on the stem, was detached from its scale, and its error found to be $-1°\cdot7$.

The anemograph was dismounted and cleaned, but is in good order, and, with the exception of the needle lubricators to the fan shaft, which have both proved failures, does not call for special remark. The Beckley rain-gauge was also in good order, with the exception of a defective pipe. The tube which conveys the rain from the funnel to the receiver is made of a very soft composition metal, which becomes so plastic in hot weather as to be unable to support its own weight. It then drops until it rests upon the floating receiver, thereby vitiating the rain record.

I should recommend the substitution of a brass or copper tube at the earliest convenience, and also that a Stonyhurst discharger and new pencil-holder should be fitted at the same time, in order that more distinct traces might be obtained than those now procured.

As at Falmouth, I examined the gauges in order to find, if possible, a cause for the disagreements occasionally observed between the indications of the Beckley and check gauges, but nothing appeared sufficiently marked to be assigned as a cause of error, and it appears probable that rain-gauges side by side may differ in their catches during gusty weather and heavy falls, from natural causes.

Kew Observatory, October 1887. (Signed) G. M. Whipple.

Dear Sir, Kew Observatory, October 1887.

I beg leave to hand you herewith my report and inspection notes regarding the self-recording instruments of the observatories at Stonyhurst and Aberdeen.

Stonyhurst, visited September 28–29.—At this observatory the whole of the instruments were in a satisfactory condition and call for no special remark.

The standard dry and wet thermometers as well as the maximum and minimum were carefully examined with the standard K.S. 642, and the following corrections were determined at 60° :—

Dry bulb, 619 - - -	−0°·2
Wet bulb, 382 - - -	−0·4
Maximum, M.O. 439 - -	−0·4
Minimum, B.T. 501 - -	+0·1

Aberdeen, October 1–7.—Here I found everything working well. Both the barograph and thermograph clocks were taken to pieces and the usual cleaning performed.

My attention having been called to the attached thermometer of the standard barometer, I found that a temporary tube, divided to every 2 degrees on the glass stem, had been fitted up by Professor Niven, as a substitute for the original thermometer which is an undivided one, and now quite useless, as the brass band fixing it to the outer casing of the barometer (which in itself is much corroded) is quite worn away, and in consequence there is no means of securing the tube to the ivory degree scale.

I would therefore suggest that another thermometer divided on the glass stem to single degrees and ranging from +10° to 120° be supplied, and, together with a small bracket for supporting it, be sent to the observatory.

The barograph was in good order and the air plug of cistern quite free from dirt or other obstruction. Its thermometer was tested and found to read 2° too high.

Anemograph.—The whole of the external parts were dismounted and thoroughly cleaned and oiled. The instrument was in a satisfactory condition, with the exception of the fans and screw of spindle, which are very much worn, so that it is very questionable whether the fans will hold together during the coming winter. I would therefore respectfully beg to draw the especial attention of the Council to Mr. Whipple's report of last year concerning these defects.

The dimensions of the spindle to which the fans are fixed are appended to my inspection notes, as well as certain measurements as to height of cups above the roof of the astronomical observatory.

The orientation was examined before and after dismounting and cleaning, and the sheet containing the results is forwarded herewith.

"Squeezes" of both the self-recording and spare rain-gauge funnels are also enclosed. The clock of the former instrument only required oiling, as it had been thoroughly cleaned (prior to my visit) at the time of attaching a new line to weight.

The following are the corrections obtained by comparison of the thermometers with the Kew Standard 642 at 55° :—

Dry-bulb, 458 - - -	−0°·15
Wet-bulb, 395 - - -	−0·6
Maximum, M.O. 1,002 - -	+0·1
Minimum, M.O. 89 - -	+0·1

Yours, &c.

R. H. Scott, Esq., F.R.S. (Signed) T. W. Baker.

APPENDIX VII.

Method of Dealing with Telegraphic Weather Intelligence.

The operations connected with the preparation and issue of the Forecasts and Storm Warnings have not undergone any material change with regard to the home stations, but there has been some change in connection with the information received from the United States. The existing arrangements are referred to fully further on. The Daily Weather Report also has again been improved by the introduction of new averages for pressure and temperature, and by a paragraph explanatory of the meaning of the storm signals exhibited on our coasts.

The Office still receives, when the telegraphic communications are perfect, fifty-nine reports every morning, seventeen every afternoon (except on Sundays), and twenty-nine each evening.

The foreign reporting stations, 28 in number, extend along the entire western coast of the Continent, from Bodö in Lat. 67° N. to Lisbon in Lat. 38° N., and include four stations on the coast of the Baltic, three in Germany, and two in the Mediterranean. The information is received in accordance with arrangements made with the various Meteorological organisations in Portugal, France, Holland, Germany, Denmark, Norway, and Sweden.

At the British and Irish stations the morning observations are taken at 8 a.m. Greenwich time, and most of the telegrams arrive in London at about 9 o'clock, when the Intelligence Department of the Post Office extracts from them the portions required for its wind and weather reports. They are then transmitted to the Meteorological Office by its private wire, where the majority of them usually arrive between 9 a.m. and 10 a.m. No material interruptions have occurred in the communication with Sumburgh Head, but there was a serious breakdown in those from Stornoway, at the end of the year.

As the reports come in, the information is entered on a chart, showing for each station at 8 a.m. the barometrical and thermometrical readings, with their respective alterations during the preceding 24 hours, the direction and force of the wind, and the state of the weather, together with any changes of importance which may have been noticed in the course of the preceding day. From this chart, which is preserved in the Office, other charts are drawn for publication in the newspapers, as described further on.

If necessary telegraphic warnings of storms or of atmospherical disturbance are immediately sent to our own coasts and to foreign countries. A brief telegraphic resumé of the weather is despatched shortly after 11 a.m. to the Harbour Authorities and the Chamber of Commerce in Jersey. Another telegraphic message, of about 75 words, is sent to the Underwriters' Association, Liverpool, containing reports of the pressure, wind and weather at 14 stations on the coasts of the British Islands; and a third message of about the same length is forwarded to the Central News and to the Exchange Telegraph Company for despatch to the provinces. The last of these messages consists of a brief statement of the general condition of weather over Western Europe, as shown by the morning reports. It is, however, not in the morning

only that storm warnings are issued to the coasts, a constant watch being kept during the day, and whenever on the receipt of the regular or of special telegrams the condition of the weather appears to be threatening, cautionary messages are at once issued to such parts of the coast as are thought to be menaced by a gale.

During the year 1886 there were prepared each morning, afternoon, and evening, Forecasts of the weather, for a day in advance; these were drawn up for eleven districts in the British Islands, and issued to subscribers, to certain Clubs, and to many of the London and Provincial newspapers in accordance with the arrangements referred to on p. 10. The districts for which the Forecasts were prepared are those into which the returns for the Weekly Weather Report are grouped, viz. :—

0. Scotland, North.
1. „ East.
2. England, N.E.
3. „ East.
4. Midland Counties.
5. England, South.
6. Scotland, West.
7. England, N.W. (with N. Wales).
8. England, S.W. (with S. Wales).
9. Ireland, North.
10. „ South.

About an hour and a quarter is occupied in the preparation and transmission of the provincial and foreign telegrams, and in the drawing up of the "Remarks" and 11 a.m. Forecasts for the London newspapers, so that the MS. copies for the "Times" and other papers are ready for issue soon after 11 a.m.

Charts are prepared daily for newspaper publication as follows :—

For the "Times," - -	two daily, viz.:	for 8 a.m. and 6 p.m.
For the Patent Type Founding Company, on behalf of the "Shipping Gazette," and for distribution to the provincial press -	one „	for 8 a.m.

The 8 a.m. charts are sent out at about 10.15 a.m. and the 6 p.m. chart at about 8.30 p.m.

In addition to the charts here referred to, the Patent Type-founding Company are supplied with various diagrams showing the changes in Pressure, Temperature, Rainfall, Wind, and Weather for the London district. These are engraved *daily* for the "Daily Chronicle," *weekly* for the "Graphic," and *monthly* for the "Miller," and are all accompanied by remarks on the phenomena exhibited.

Charts are drawn for 8 a.m. and 6 p.m. daily for exhibition at the Office door, and special Remarks, with the latest Forecasts issued, are prepared and posted at the door three times daily.

The draft of the Daily Weather Report, with two charts attached, is drawn on transfer paper, and is ready by noon, when it is at once sent to the lithographer to be printed. The copies for delivery by hand and by early post in London are issued at about 1.30 p.m., while the remainder are received at the Meteorological Office at about 3.30 p.m. whence they are transmitted by post to the subscribers and others.

The 2 p.m. observations, taken at fifteen home and two foreign stations (Skudesnaes and Rochefort) are received at about 3 o'clock.

Copies of these are issued, together with the 8 a.m. report, to certain newspapers and subscribers, and two copies of the "Remarks" (8 a.m. and 2 p.m.) are sent to the Type-founding Company for issue to provincial newspapers, in order to explain the 8 a.m. charts mentioned above.

The evening (6 p.m.) reports arrive at about 7 to 7.30 p.m., and are charted and discussed for the morning daily papers in accordance with the arrangement referred to on p. 10. The forecasts and remarks are usually ready by 8.30 p.m., but in bad weather, owing to the delay of the reports, and the additional care which is necessary in dealing with them, it is occasionally 9 p.m. before they are issued. The "Times" publishes in its First Edition the map showing the distribution of pressure, the winds, temperature, and weather at 6 p.m. on the previous day, and in its Second Edition the similar map for 8 a.m. on the day of issue.

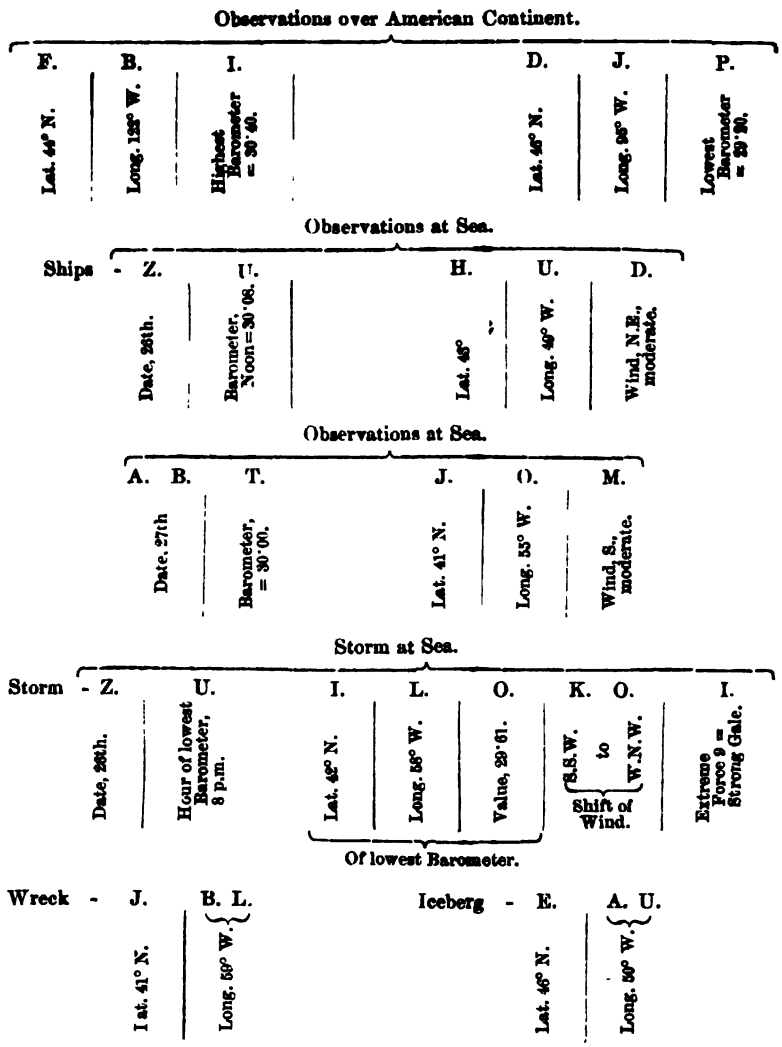
The charts for 2 p.m. and for 6 p.m. are still much less complete than that for 8 a.m., notwithstanding the great improvements recently made. That for 2 p.m. is drawn on the information received from fifteen home stations, supplemented by two foreign ones, whenever the latter arrive in time to be used. The material for the 6 p.m. charts is now supplied by reports from twenty stations in the United Kingdom, supplemented by nine from continental stations, but the latter occasionally arrive late at the very time when they are most wanted, *i.e.*, during bad weather.

The Sunday duty is still conducted as follows:—Two of the clerks attend on Sunday mornings at the Central Telegraph Station from 8.30 a.m. to about 10.15 a.m. By an arrangement with the Post Office these clerks are supplied with the telegrams immediately they arrive in London. These are examined and charted, with the view of issuing, when necessary, warnings of coming storms, to our own and neighbouring coasts. It is necessary that great promptitude should be observed in this service, as the observations must be dealt with and the warnings issued so that the latter may reach the coast before the telegraph offices at the outports close for the day, which is usually at about 10 a.m. No work of any kind is transacted for the newspapers on Sunday mornings, the main object of the service being to give early information of storms to our coasts; but a telegram is sent to Jersey in the same form as on week days, and there is the ordinary interchange of messages with foreign countries. A copy of the Valencia message is sent to Lisbon as on week days. At 6 p.m. the same clerks attend at the Meteorological Office to receive the evening reports and to prepare the 8.30 p.m. Forecasts, and another opportunity is thus afforded for the correction or extension of any warnings which may have been issued in the morning.

Atlantic Telegrams.

In the course of the year the arrangements for receiving from the United States occasional reports of gales, icebergs, and derelict ships, which have been met with by passenger steamers of the principal lines running from various European ports to New York or Boston have been modified. The information is conveyed by means of a Code, drawn up in the following manner, and further changes are contemplated

by the French Authorities, as the Meteorological Council do not feel justified in continuing expenditure on this branch of the work:—


Observations over American Continent.
F. Lat. 44° N.
B. Long. 125° W.
I. Highest Barometer = 30·40.
D. Lat. 46° N.
J. Long. 98° W.
P. Lowest Barometer = 29·30.
Observations at Sea.
Ships - Z. Date, 26th.
U. Barometer, Noon = 30·08.
H. Lat. 48°
U. Long. 40° W.
D. Wind, N.E., moderate.
Observations at Sea.
A. B. Date. 27th
T. Barometer, = 30·00.
J. Lat. 41° N.
O. Long. 53° W.
M. Wind, S., moderate.
Storm at Sea.
Storm - Z. Date, 26th.
U. Hour of lowest Barometer, 8 p.m.
I. Lat. 42° N.
L. Long. 58° W.
O. Value, 29·61.
Of lowest Barometer.
K. S.S.W.
O. to W.N.W.
Shift of Wind.
I. Extreme Force 9 = Strong Gale.
Wreck - J. Lat. 41° N.
B. L. Long. 59° W.
Iceberg - E. Lat. 46° N.
A. U. Long. 50° W.

This arrangement has been made through M. Mascart, the Director of the French Meteorological Bureau, to whom the messages are telegraphed direct from the United States. They are forwarded from Paris to this country by post, in order to curtail the cost of transmission.

Daily Weather Report.

No considerable change has been made during the past year in the *form* of the Daily Weather Report, but improved average values for pressure and temperature are now given in the margin on p. 2. The values now quoted are, the monthly averages of pressure for 8 a.m. with Maximum, Minimum, and 8 a.m. temperatures for 25 stations, during the 15 years 1871–85. The mean monthly rainfall values are those for the

20 years 1866–85. The Report fills four large quarto pages, and is arranged as follows:—

Page 1 contains the whole of the 59 reports from which the maps for the day (given on page 2) are prepared, and the 6 p.m. reports of the previous day, together with the maximum and minimum temperatures of the air, and the Rainfall for the previous 24 hours.

Page 2 contains (1) a map of North-western Europe showing for 8 a.m. on the date of publication, the distribution of pressure, the prevalent winds, and the sea disturbance, with necessary explanations; together with a table showing the mean atmospheric pressure for the month at 25 stations; (2) a similar map showing the distribution of temperature at 8 a.m., the weather at each station, and the distribution of rainfall during the past 24 hours; together with a table of the mean temperature of the air and of evaporation at 8 a.m., the means of the daily maximum and minimum temperatures, and the mean rainfall for the month at the same 25 stations in the United Kingdom.

Page 3 contains (1) notes on the "General situation at 8 a.m.," and the "Probable changes in system now prevalent;" and (2) the forecasts drawn up for each district at 11 a.m., relating to the weather likely to be experienced during the 24 hours ending at noon on the day succeeding that of publication, and an explanation of the meaning of the storm signals exhibited on our coasts.

Page 4 contains the reports for 2 p.m. on the previous day, an account of the distribution of pressure, temperature, wind, and weather experienced over the European Continent on the previous day, and, on Mondays, a brief summary of the weather experienced during the previous week.

The standing portion of the report (maps, &c.) is printed in blue, while the information for each day is in black.

The lithographed Reports have the Forecasts issued at 11h. a.m. incorporated with them on each week day. The subscription for the Report is—

For delivery by hand, where feasible, £2 *per annum;*
Do. by book post £1 „

MS. copies of the observations and Remarks can be supplied at the rate of 2*l.* 10*s.* per annum. Arrangements can also be made for the supply of charts drawn from the 8h. a.m. or 6h. p.m. observations, such as appear in the "Times."

Correction and Addition List.

Additional steps are taken to insure accuracy in the Daily Weather Report. At the close of each month a return is received from nearly all of the telegraphic reporting stations, containing a copy of all the observations which have been transmitted to London by wire during the month. These schedules are used for checking the daily telegrams, for the preparation of the average and other values of the different elements, and also as evidence in the case of legal proceedings. About the middle of every month a lithographed sheet has for many years past been issued with the Daily Weather Report, containing corrections for all discrepancies which have been discovered, and supplying any observations which have been omitted in the daily reports for the previous month. This monthly sheet contains also tables showing, for each telegraphic reporting station within our Islands, the mean values for pressure, temperature, and humidity, together with the total rainfall, and the prevalence of various kinds of weather and of winds from each of the eight principal points during the month.

Weekly Weather Report.

The Weekly Weather Report, which has appeared since the beginning of February 1878, has been further improved by the insertion on the last page of reports from six new inland Scotch stations, the values for which are included in preparing the summary given on the first page.

The Summary on the first page contains the average and extreme temperatures, the rainfall values and the total amount of bright sunshine in each week, for twelve districts in Great Britain and Ireland, together with the difference between them and the respective mean values for the corresponding week in previous years. In addition to this, the district values for Accumulated Temperature, Rainfall, and Bright Sunshine are given, both for the week and for the whole period since the beginning of the year, with their difference from the average values. This information is derived from observations made at 77 stations, the individual values for which are given on the last page of the Report.

The tables of Accumulated Temperature are designed to give persons engaged in agriculture better means of estimating the manner in which vegetation is affected by temperature than that afforded by the more usual methods of treating the readings of the thermometer. They show for each week, and for the whole period from the beginning of the year, the weekly and progressive values respectively, of the combined amount and duration of the excess or defect of the air temperature, above or below a suitably fixed standard or *base temperature*. The base adopted is 42° F., as being nearly equivalent to 6° Cent. which has been considered by Continental writers on these subjects to be the critical value, the temperature above which is mainly effectual in starting and maintaining the growth, and in completing the ripening of agricultural crops in a European climate. This base is also convenient as being 10° F. above the Freezing Point.

Accumulated Temperature is expressed in Day-degrees; a Day degree signifying 1° F. of excess or defect of temperature above or below 42° F. continued for 24 hours, or any other number of degrees for an inversely proportional number of hours.

It has been ascertained by calculation from a considerable series of hourly observations at various places, that the accumulated temperature may be computed, with a very tolerable approximation to the truth, from the observed daily maximum and minimum temperatures alone.

When the temperature during any period remains either wholly above or below the base temperature, the difference between the base and the mean temperature gives the correct accumulated value. In other cases this difference gives an approximate value of the accumulated temperature which does not depart greatly from the truth, the deviation depending on the greater or less extent of the daily variations of the temperature above or below the base. Further, since the mean between the maximum and minimum of any day is nearly equal to the mean temperature of the day, the difference of the mean of the maximum and minimum from the base also will give directly a fair approximation to the accumulated temperature for the day.

The following rules, however, supply still more closely the values sought, and they have been adopted for the preparation of the table in the Weekly Weather Report. They may be applied to any other base temperature as well as to 42° F., with the slight modification of the numerical coefficients.

RULES for computing for a WEEKLY PERIOD the ACCUMULATED TEMPERATURE above or below 42° F. from the observed MAXIMA and MINIMA.

1. Obtain the mean temperature from the means of the seven observed maxima and minima by multiplying the difference between them by the proper coefficient for the month, and adding the result to the mean of the minima.

2. In obtaining the accumulated temperature four cases may occur, to which the following rules will apply :—

Conditions of Temperature.	To obtain the Accumulated Temperature.	
	Above 42° F.	Below 42° F.
If the minimum is *above* 42° F. or *equal* to 42° F.	Subtract 42° F. from the mean.	There is none.
If the minimum is *below* 42° F., but the mean for the day is *above* 42° F.	From the difference between the mean for the day and the minimum deduct the accumulated temperature below 42° F., calculated as stated in the next column.	The required quantity is the excess of 42° F. over the minimum multiplied by the coefficient 0·4.
If the mean for the day is *below* 42° F., but the maximum is *above* 42° F.	The required quantity is the excess of the maximum over 42° F. multiplied by the coefficient 0·4.	From the difference between the mean for the day and the minimum deduct the accumulated temperature above 42° F., calculated as stated in the preceding column.
If the maximum is *below* 42° F., or *equal* to 42° F.	There is none.	Subtract the mean from 42° F.

In each case the result will be the mean *daily* value for the week, and must be multipled by 7 in order to obtain the value for the whole week.

The coefficient varies both with the length of the period and the value of the base line. In the above instance the base is 42°; when it is 32° the coefficient is 0·4; when 52° it is 0·33; and when 62° it is 0·25.

A full explanation of these rules will be found in Appendix II. to the Quarterly Weather Report for 1878.

The temperature means derived from the daily maxima and minima are corrected so as to agree as closely as possible with the true mean daily value, and, the average values for the corresponding period in former years having been recomputed, those now in use are :—

For Temperature - - 20 years 1861–80
„ Rainfall - - 20 „ 1866–85

These statistics are given on the first page of the publication, the temperature, accumulated heat, rainfall, and sunshine values for *each station** being given on the last page of each report.

In addition to the telegraphic reports, and the returns from the self-recording observatories, weekly returns from 43 volunteer observers are

* The sunshine values are furnished for only a limited number of carefully selected stations. See p. 112.

used in preparing this report, the names of the observers at each station being as under—

Names of Stations.	Names of Authorities.
Alnwick Castle - - -	Lieut.-Col. F. Holland, for the Duke of Northumberland, K.G.
Arlington (N. Devon) - -	J. Carter, for Lady Chichester.
Bawtry (Hesley Hall) - -	B. I. Whitaker, F.R. Met. Soc.
Blackpool - - - M	J. Wolstenholme, F.R. Met. Soc.*
Braemar - - - S	J. A. Aitken.
Brookeborough - - -	Mr. Ferguson, for Sir Victor Brooke, Bt., F.L.S.
Cheadle - - - M	J. C. Philips.
Churchstoke - - - M	P. Wright, F.C.S., F.R. Met. Soc.
Cirencester - - -	The Royal Agricultural College.
Cullompton - - - M	T. Turner, J.P., F.R. Met. Soc.
Douglas (Isle of Man) - -	A. W. Moore, M.A., J.P.
Dublin - - - -	J. W. Moore, M.D., F.R. Met. Soc.
Durham Observatory - -	H. J. Carpenter.
Edgeworthstown (Currygrane) -	J. M. Wilson, D.L., J.P.
Fort Augustus - - S	Rev. W. M. Wall.
Foynes - - - -	W. Ward, for Lord Monteagle, K.P.
Geldeston - - - -	E. T. Dowson, F.R. Met. Soc.
Glen Carron - - S	D. D. Munro.
Glenlee - - - S	G. Maxwell and W. Melville.
Hastings (St. Leonard's) - -	H. Colborne, M.R.C.S.
Hereford - - - M	T. A. Chapman, M.D.
Hillington - - - M	Rev. H. E. B. Ffolkes, M.A., F.R. Met. Soc.
Ingatestone - - - -	L. J. Petre, F.R. Met. Soc.
Kilkenny - - - -	H. Carlton, for the Marquis of Ormonde.
Killarney - - - -	The Ven. Archdeacon Wynne, F.R. Met. Soc.
Lairg - - - S	W. Ross, Ground Officer.
Laudale (Loch Sunart) - -	A. Fletcher, for T. H. G. Newton, F.R. Met. Soc.
Leicester - - - -	J. C. Smith, the Museum.†
Llandovery - - - -	J. Watkins, F.R. Met. Soc.
Llandudno - - - M	J. Nicol, M.D., F.R. Met. Soc.
Londonderry - - -	J. Conroy, F.R. Met. Soc.
Manchester (Prestwich) - -	T. R. H. Clunn, M.D., F.R. Met. Soc.
Marchmont - - - S	P. Loney.
Markree Castle (Sligo) - -	A. Marth, F.R.A.S., for Colonel Cooper, F.R.A.S.
Newton Reigny (Penrith) - -	T. G. Benn, F.R. Met. Soc.
Ochtertyre - - - S	G. Croucher.
Plymouth - - - -	J. Merrifield, LL.D., F.R.A.S.
Rothamsted - - -	Rainfall by Sir J. B. Lawes, Bart., LL.D., F.R.S., and J. H. Gilbert, Ph.D., F.R.S.; temperature by T. Wilson, F.R. Met. Soc.
Scarborough - - - M	W. Robinson.‡
Southampton - - -	J. T. Cook, R.E., Ordnance Survey Office.
Stowell - - - M	Rev. H. J. Poole, F.R. Met. Soc.
Strathfield Turgiss - - M	Rev. C. H. Griffith.
Waterford (Brook Lodge) - -	C. Percival Bolton, J.P.

The returns marked "M" are supplied through the Royal Meteorological Society, those marked "S" are through the Scottish Meteorological Society.

* Rev. C. T. Ward ceased reporting at the end of June, 1887.

† Mr. Smith has since died, and the observations at Leicester have ceased.

‡ Mr. Rowntree ceased reporting early in the year.

The report is prepared on Wednesday in every week, and is ready for sale early on Saturday morning, but the summary on its first page is sent to the "Times," "Daily News," and some other papers on Wednesday evening.

Appendices.

Appendix I.—This contains (1) Summaries for each Quarter and for the whole year of the Temperature and Rainfall records for each District, and (2) Tables giving for each district the monthly values for Rainfall, Accumulated Temperature (above and below 42° F.), and Bright Sunshine, as well as the progressive values for each from the commencement of the year, in continuation of the values given for 1878 to 1886.

Appendix II. gives for year 1887, and for each District, the weekly and progressive values for Rainy days, Amount of Rainfall, Accumulated Temperature (above and below 42° F.), and Bright Sunshine, in continuation of the values for the years 1878–86 printed in Appendix II. to the Weekly Weather Report for 1886.

Appendix III. gives for each District, during the nine years 1878–86, and also during the ten years 1878–87, the mean aggregate values from the beginning of the year to the end of each week in the year for the following years 1881–86, and for the seven years 1881–87 the corresponding values for Bright Sunshine (both the Number of Hours recorded, and the per-centages of possible duration. These are in continuation of the values published in Appendix III. of the Report for 1886.

Appendix IV. gives for each District—(*a*) for the eight years 1878–85, (*b*) for the nine years 1878-86, and (*c*) for the ten years 1878–87—the Mean Temperature of the Air for each Week in the year. This Appendix is entirely new.

Monthly Weather Report.

The publication of the *Monthly Weather Report*, though interrupted for a time by various unavoidable causes, is being continued. It contains, as hitherto, (1) A General Summary for the Month, of the weather experienced over the United Kingdom and its neighbourhood; (2) Tables of the principal Cyclonic and Anticyclonic Systems which have passed over our area during the month; and (3) Tables of Pressure, Temperature, Hygrometric Deductions, Rainfall, Weather, Wind, and Bright Sunshine experienced at a large number of stations scattered over the United Kingdom, together with remarks thereon; it is illustrated by two plates. The report is, therefore, as far as possible, similar to the Quarterly Weather Report, but cannot contain either the Gale Tables, or the Tables of Mean Values for the Observatories, which are found in its predecessor.

Issue of Forecasts.

Remarks on the actual state of the weather, and forecasts *for not more than one day in advance*, are prepared at the Meteorological Office as under:—

On Week Days.

(1.) At 11 a.m. (from the morning reports), for the 24 hours ending at Noon on the day following the date of issue. This issue is intended especially for the early editions of the evening papers, for the clubs, and for exhibition at certain selected stations. See p. 10.

(2.) At 3.30 p.m. (from the morning and afternoon reports), for the day following that of issue. This set of Forecasts is not intended for publication in newspapers, but a copy is exhibited regularly at the door of the Meteorological Office.

(3.) At 8.30 p.m. (from the 6 p.m. reports), for the day following that of issue. These are now supplied gratis to any newspaper or news agency which may apply for them, and send for them regularly. A very large number of the most important papers avail themselves of this advantage.

The forecasts are made for the following districts:—

0. SCOTLAND, NORTH.
1. SCOTLAND, EAST.
2. ENGLAND, N.E.
3. ENGLAND, EAST.
4. MIDLAND COUNTIES.
5. ENGLAND, SOUTH.
6. SCOTLAND, WEST (with Isle of Man).
7. ENGLAND, N.W. (with North Wales).
8. ENGLAND, S.W. (with South Wales).
9. IRELAND, NORTH.
10. IRELAND, SOUTH.

The remarks and forecasts are posted at the doors of the Meteorological Office, 116, Victoria Street, S.W., on week days*, for the inspection of the public. Copies, or extracts from them, are communicated under the conditions stated below, but no information which is not substantially included in them can be supplied.

FORECASTS FOR PRIVATE SUBSCRIBERS.—Any person can be supplied with a copy of the 11 a.m. Forecasts, once on each week day,* on payment of a subscription of ten shillings per annum, or 2*s.* 6*d.* per official quarter, *or any part thereof, in addition to the cost of transmission*; the charges will therefore be, by *letter* post, 9*s.*, by *book* post, 5*s.* 9*d.* per quarter.

The forecasts for any of the districts and for any of the hours mentioned above can be forwarded by telegraph daily, on payment of 3*d.* per day for any definite period of not less than one week, in addition to the cost of telegraphy.

FORECASTS FOR CLUBS.—Forecasts, drawn up at 11 a.m., for all the districts, are supplied to Clubs, for a subscription of ten shillings per annum. These are delivered free, by hand, to Clubs situated in or near Pall Mall. Special arrangements can be made for delivery at a greater distance by hand or by post.

FORECASTS FOR HAY AND CORN HARVESTS, OR FOR PUBLIC USE.—Special facilities are offered for the transmission of Forecasts for these purposes, a nominal fee of 2*s.* 6*d.* being charged for a quarter or any part thereof, in addition to the cost of the telegrams.

EXHIBITION OF TELEGRAPHIC FORECASTS AT LOCAL POST OFFICES.—The Post Office has sanctioned the exhibition of Forecasts at Local Post Offices, provided space is available, if the persons to whom they are addressed desire them to be so exhibited instead of being delivered.

Unless otherwise arranged, all forecasts transmitted by post are sent by book post, not as letters.

* Good Friday and Christmas Day are reckoned as Sundays.

Inquiries as to the Weather.

Inquiries Personally or by Messenger.—Any person applying at the Meteorological Office between 11 a.m. and 8 p.m. on week days, and between 7 p.m. and 8 p.m. on Sundays, can be supplied, in writing with the latest information in the possession of the Office and with the latest forecast issued for any specified district, on payment of one shilling for each inquiry.

Inquiries by Letter.—Application may be made by letter, enclosing thirteen pence in stamps if the reply is to be *by post*, and one shilling in stamps in addition to the cost of the reply, consisting of ten words, exclusive of the address, if the reply is to be *by telegraph*.

Inquiries by Telegraph.—Any person may obtain *by telegraph* from the Meteorological Office the latest information as to the weather in any district of the United Kingdom by payment of a fee of 1*s*. in addition to the cost of a telegram and reply to any post office. The telegram containing the inquiry must be addressed as follows:

Weather,
London.

The payment for the reply should be for at least ten words in addition to the address.

Application may also be made for similar information to be sent either *by telegraph* or *post* on some future specified day.

Checking of Forecasts.

In order to test the accuracy of the forecasts they have been compared carefully with the weather reported in the various districts on the days to which they referred, and the results of this checking for 8.30 p.m. are given in the Report (p. 11).

In carrying out this comparison the portions of the forecasts which referred to wind have been carefully separated from those relating to weather. The detailed results of the comparison will be found in Appendix XI., p. 98.

Checking of Storm Warnings.

The testing of the warnings is conducted in the following manner. The intelligence issued is compared with the weather experienced on the coasts, as indicated by the various self-recording anemometers, by the telegraphic reporters, and by several gentlemen who have volunteered to observe for the Office, and whose names will be found in Appendix XIV., p. 108.

In order to render the information in the possession of the Office as to the weather experienced on our coasts still more complete, the Council have, as in preceding years, made application to the various Light-house Boards, and have obtained from them the original log-books from some of the most exposed lightships and lighthouses. They would here express their cordial thanks for the co-operation so readily granted to them by these Boards.

The result of the checking for 1887 will be found on p. 14.

The coasts are subdivided into ten districts, as will be seen in the table. Two large tracts of coast are entirely omitted: viz., the west of Ireland from the Shannon to Malin Head, and the West of Scotland from the Mull of Cantyre to Cape Wrath. No warnings are issued to any place within the limits indicated, except to Galway, and

the amount of information as to the weather received from the omitted portion of the Scotch coast is, as yet, very scanty.

It should be remembered that in analysing the reports, all observations of the wind in which the force *exceeded* 7 (a "moderate gale") or the velocity exceeded 40 miles an hour, have been quoted as instances of the occurrence of a gale; but it has not been considered that the signal was hoisted late or was hauled down too soon, unless the force of 9 (a "strong gale") or the velocity of 50 miles an hour, was reached prior to the issue of the order to hoist, or subsequent to the issue of the order to lower.

In the Summaries all cases in which the signal has been shown to be late by a single report either of force 9, or of a velocity of 50 miles an hour, have been specially noted.

APPENDIX VIII.

List of Persons, Places, &c. to which the Lithographed Daily Weather Report is supplied, free of cost.

Newspapers:

Lloyd's Shipping List.
New York Herald.
Times.

For Exhibition at Seaports:

Banff.
Barrow-in-Furness.
Belfast.
Blackpool.
Bo'ness.
Boscastle.
Brighton.
Briton Ferry.
Broughty Ferry.
Buckie.
Budehaven.
Caernarvon (2 copies).
Cork.
Cowes.
Crail.
Cromer.
Cullercoats.
Dover.
Dundee.
Eastbourne.
Exeter.
Exmouth.
Falmouth.
Glasson Dock, Lancaster.
Great Grimsby (2 copies).
Groomsport.
Hastings.
Hayle.
Holyhead.
Kingstown (2 copies).
Leith.
Lowestoft.
Margate.
Morecambe (2 copies).
Nairn.
Newquay.
Penarth.
Plymouth.
Plymouth, G. W. Docks.
Port Dinorwic.
Porthcawl.
Queenstown.
St. Leonard's.
St. Sennen Cove.
Scarboro'.
Southport.
Teignmouth.
Ventnor (2 copies).
Whitby.
Wisbech.
Yarmouth.

Offices, Institutions, &c.:

Aberdeen Observatory.
Admiralty (11 copies).
Aldershot, Garrison Library.
Armagh Observatory.
Army Medical Department.
Ben Nevis Observatory.
Board of Trade (3 copies).
"Britannia," H.M.S., Dartmouth.
British Museum.
Channel Squadron (Admiral).
Chatham, Instructor in Surveying (2 copies).
Commons, House of.
Cooper's Hill, Royal Indian C.E. College.
Deptford, Naval Storekeeper.
Devonport Dockyard (2 copies).
„ Commander-in-Chief.
„ Captain of Steam Reserve.
„ Master Attendant.
Dublin, General Register Office.
„ Royal College of Science.
Durham, University Observatory.
Eastern Telegraph Company.
Edinburgh, Scottish Meteorological Society.
Falmouth Observatory.
Farnborough Station, Staff College.
Fleetwood, L. &. W.N. Railway Company.
General Register Office.
„ „ „ for Seamen.
Glasgow Observatory.
Greenwich, Royal Observatory.
„ R.N. College.
Haslar, R.N. Hospital.
"Indus," H.M.S., Devonport.
Kew Observatory.
Lords, House of.
"Nankin," H.M.S., Milford Haven.
Navy Medical Department.
Oxford, Radcliffe Observatory (2 copies).
Portland, Senior Naval Officer.
Portsmouth, Commander-in-Chief.
„ Dockyard.
„ R. N. College Observatory.
Prestwich Asylum, near Manchester.
Queenstown, Rear-Admiral.
Royal Meteorological Society.
Royal Society (2 copies).
Rugby Natural History Society.
Science and Art Department (2 copies).
Sheerness, Commander-in-Chief.
„ Dockyard.
Sheffield, Public Museum.
Southampton, Ordnance Survey Office.
Southport, Fernley Observatory.
Stonyhurst Observatory.
Valencia Observatory.

Offices, Institutions, &c.—cont.

War Office, Adjutant General, Horse Guards.
„ Commander-in-Chief.
Woolwich, Army Medical Department.
„ Royal Military Academy.
Yorkshire Philosophical Society (2 copies).

Miscellaneous Persons:

Agents at Out-ports (2 copies).
Aird, G. H., Seaham.
Benn, T. G., F.R. Met. Soc., Newton Reigny.
Clark, J. E., B.A., B.Sc., York.
Colborne, H., M.R.C.S., St. Leonard's.
Conroy, J., F.R. Met. Soc., Londonderry.
Cooper, Col., F.R.A.S., Markree, near Sligo.
Crossley, Mrs., Halifax.
De La Rue and Co.
Dowson, E. T., F.R. Met. Soc., Geldeston, Beccles.
Farrer, Sir T. H., Bart.
Freeden, W. H. von, Bonn.
Griffith, Rev. C. H., Strathfield Turgiss.
Ley, Rev. W. C., M.A., Lutterworth.
Mann, J. R., Osborne.
Mellish, H., F.R. Met. Soc., Worksop.
Meteorological Council (3 copies).
Moore, A. W., M.A., J.P., Douglas, Isle of Man.
Moore, F. W., Glasnevin, Botanic Gardens, Dublin.
Moore, J. W., M.D., F.R. Met. Soc., Dublin.
Mullins, Rev. G. H., M.A., F.R. Met. Soc., Uppingham.
Northumberland, Duke of, K.G., Alnwick.
Preston, Rev. T. A., M.A., F.R. Met. Soc., Leicester.
Propert, W. P., LL.D., F.R. Met. Soc., St. David's.
Richards, Adm. Sir G. H., K.C.B., F.R.S., London.
Rosse, Earl of, F.R.S., Parsonstown.
Stow, Rev. F. W., M.A., F.R. Met. Soc., Aysgarth, Bedale.
Telegraphic Reporters (25 copies).
Wilson, J. M., J.P., Blackrock, Dublin.

Foreign Places:

Algiers, Meteorological Service.
Amsterdam Meteorological Institute.
Bombay, Observatory.
Brussels, Royal Observatory.
Cairo, Observatoire Khédivial.
Calcutta, Meteorological Department.
Chemnitz, Meteorological Service of Saxony.
Christiania, Meteorological Institute.
Constantinople, Imperial Meteorological Observatory.
Copenhagen, Meteorological Institute.
Cracow, Observatory.
Florence, Museum.

***Foreign Places*—cont.**

Hamburg, Deutsche Seewarte (2 copies).
Lisbon, Observatory.
Madrid, Royal Observatory.
Melbourne, Observatory.
Munich, Meteorological Office.
Paris, Central Meteorological Bureau.
„ Meteorological Society.
„ Ministry of Marine.
Rome, Meteorological Institute.
San Fernando, Observatory.
St. Petersburg, Central Physical Observatory.
Stockholm, Meteorological Institute.
Tokio, Imperial Meteorological Observatory.
Toronto, Meteorological Office.
Upsala, University Observatory.
Utrecht, Royal Meteorological Institute.
Vienna, Imperial Meteorological Institute.
Washington, Smithsonian Institution.
„ United States Naval Observatory.
„ Chief Signal Officer, War Office.
Zürich, Central Meteorological Institute.

APPENDIX IX.

Fishery Barometers.

List of Places supplied with Fishery Barometers.

Shetland Isles.—Balta Sound, Uya Sound, Nesting, Lerwick, Sandsair, Scalloway, Symbister.

Orkney Isles.—Burra. Kirkwall.

Scotland, east coast.—Stroma, Keiss, Staxigoe, Wick, Sarclet, Lybster, Dunbeath, Portmahomack, Cromarty, Avoch, Nairn, Burghead, Portessie, Port Knockie, Portsoy, Whitehills, Gardenstown, Rosehearty, Pitullie, Inverallochy, Pointlaw, Findon, Portlethen, Muchals, Skateraw, Stonehaven, Arbroath, Broughty Ferry, St. Andrews, Crail, Cellardyke, St. Mouance, Burntisland, Newhaven.

England, east coast.—Berwick, Beadnell, North Shields, South Shields, Sunderland, West Hartlepool, Staithes, Scarborough, Filey, Flamborough, Bridlington Quay, Withernsea, Hull, Lynn (2), Wells, Gorleston, Harwich, Brightlingsea, Wivenhoe, Margate, Deal, Kingsdown, Dover (2).

England, south coast.—Bognor, Ryde, Ventnor (2), Gorey (Jersey), Haslar Hospital, Poole, Exmouth, Weymouth, Portland, Budleigh Salterton, Cawsand, Mevagissey, Gorranhaven, Devoran, Portscath, Penryn, Durgan, Porthallow, Falmouth, Coverack, Newlyn, Mousehole.

England, south-west coast.—St. Ives, Hayle, Padstow, Port Isaac, Boscastle, Highbridge, Weston-super-Mare.

Wales.—Briton Ferry, Swansea, Angle, Milford, Abersoch.

England, north-west coast.—Fleetwood, Morecambe, Maryport.

Isle of Man.—Douglas, Port St. Mary, Peel.

Scotland, south-west coast.—Port Patrick, Stranraer.

Ireland, east coast. — Cushendall, Belfast, Bangor, Groomsport, Donaghadee, Ardglass, Carlingford, Greenore, Dundalk, Malahide, Howth, Kingstown (2), Bray, Wicklow.

Ireland, south coast.—Dunmore, Dungarvan, Crosshaven, Kinsale, Union Hall, Castletownsend, Baltimore, Schull, Crookhaven.

Ireland, west coast.—Valencia, Dingle, Tralee, Tarbert, Kilcredane, Barna, Elly Bay, Ballyglass, Ballycastle (Co. Mayo), Donegal, Tribane, Killybegs, Teelin, Portnoo, Burton Port, Bunbeg.

Ireland, north coast.—Dunfanaghy, Rathmullen, Buncrana, Moville, Portrush, Portstewart.

Scotland, west coast.—Tarbert, Campbeltown, Carradale, Portree (Isle of Skye), Plockton.

Hebrides.—Stornoway, Cromore, Babyle, Obb, Ness.

SUMMARY of STATIONS supplied with INSTRUMENTS.

England and Wales - - - - -	66
Scotland - - - - - -	55
Ireland - - - - - -	46
	167

APPENDIX X.

TELEGRAPHIC WEATHER INTELLIGENCE.

The following stations are supplied with telegraphic information of storms, free of expense, and signal "cones" have been furnished to most of them, all further expenses attendant on the maintenance and repair of the apparatus being borne locally. The stations are situated,

84 in England and Wales, 41 in Scotland, 15 in Ireland, 3 in the Isle of Man, and 3 in the Channel Islands.

NORTH.	WEST.	SOUTH.	EAST.
SCOTLAND. EAST COAST.	ENGLAND, N.W.	ENGLAND, S.W.	ENGLAND, E.
Dunrossness.	Ramsey.	Ilfracombe.	Eyemouth.
Lerwick.	Douglas.	Appledore.	Berwick-on-Tweed.
Scalloway.	Castletown.	Boscastle.	Tynemouth.
Stromness.	Silloth.	Port Isaac.	S. Shields.
Kirkwall.	Maryport.	Newquay.	Sunderland.
Holborn Head.	Workington.	Hayle.	Middlesborough.
Wick.	Whitehaven.	Scilly.	Redcar.
Inverness.	Barrow.	St. Sennen.	Whitby.
Nairn.	Morecambe.	St. Just.	Filey.
Burghead.	Fleetwood.	Penzance.	Bridlington Quay.
Lossiemouth.	Blackpool.	Falmouth.	Hull.
Buckie.	Lytham.	Pendennis.	Goole.
Port Knockie.	Southport.	Mevagissey.	Grimsby.
Portsoy.	Runcorn.	Plymouth.	Boston.
Banff.	Liverpool.	Teignmouth.	Sutton Bridge.
Cullen.		Exmouth.	Lynn.
Fraserburgh.	ENGLAND, W.		Sheringham.
Peterhead.	Connah's Quay.		Cromer.
Aberdeen.	Port Penrhyn.		
Stonehaven.	Holyhead.		
Montrose.	Port Dinorwic.		
Broughty Ferry.	Carnarvon.		
St. Andrews.	Aberystwith.	ENGLAND, S.	ENGLAND, S.E.
Dundee.	Milford.		
Bo'ness.	Pembrey.	Guernsey.	Yarmouth.
Grangemouth.	Llanelly.	St. Helier's (Jersey).	Southwold.
Anstruther.	Swansea.	Gorey (Jersey).	Ipswich.
Pittenweem.	Briton Ferry.	Weymouth.	Harwich.
Burntisland.	Porthcawl.	Poole.	Chatham.
Granton.	Penarth.	Cowes.	Sheerness.
Newhaven.	Cardiff.	Ryde.	Faversham.
Leith.	Newport.	Portsmouth.	
Fisherrow.	Weston-super-Mare.	Littlehampton.	
Dunbar.	Burnham.	Brighton.	
Cockburnspath.		Newhaven.	
		Hastings.	
	IRELAND, E.	Rye.	
	Belfast.	Sandgate.	
	Donaghadee	Folkestone.	
	Howth.	Dover.	
FIRTH OF CLYDE.	Kingstown.	Margate.	
Glasgow.			
Greenock.	IRELAND, S. and W.		
Rothesay.	New Ross.		
Campbelton.	Dunmore East.		
Girvan.	Dungarvan.		
Ballantrae.	Youghal.		
	Queenstown.		
	Passage.		
	Kinsale.		
	Cork.		
	Tralee.		
	Limerick.		
	Galway.		

The signals used consist of:—

1. Cone, point downwards for Southerly gales; S.E. round by S. to N.W.
2. Cone, point upwards for Northerly gales; N.W. round by N. to S.E.

The signals are to be kept hoisted *during the daylight only*, until 48 hours have elapsed from the time *the telegram was despatched*, unless countermanded. At night, lanterns may be used wherever the local authorities deem it desirable to do so.

The meaning of the signals is that an atmospherical disturbance exists (which will be explained in the telegram), and will probably, but not *necessarily*, cause a gale at the place warned, *from the direction* indicated by the signal.

The Meteorological Office supplies the canvas shapes and lanterns to such places as require them, on loan, but in all cases the local authorities must undertake the charges incidental to the hoisting of the signal, such as flagstaff and gear, oil, &c., and also to the keeping of the apparatus in repair, painting, &c.

APPENDIX XI.

REPORT ON THE COMPARISON OF THE FORECASTS ISSUED AT 8h. 30m. p.m. WITH THE WEATHER SUBSEQUENTLY EXPERIENCED, for the 12 Months, April 1887 to March 1888.

The letters used have the following signification:—

a = complete success.	**c** = partial failure.
b = partial (more than half) success.	**d** = total failure.

The checking has been conducted on the same system as that employed in previous years, *i. e.*, each forecast has been considered under the separate headings of "Wind" and "Weather," but the results of the 8 p.m. Forecasts only are here published.

The first column gives the percentage of success in "Wind," the second in "Weather," and the third the average of the two.

The Summary for the whole year is given at page 11.

Districts.		April 1887. Percentages. Wind.	Weather.	Average.	a+b.	May 1887. Percentages. Wind.	Weather.	Average.	a+b.	June 1887. Percentages. Wind.	Weather.	Average.	a+b.
Scotland, N.	a	40	47	44		61	48	55		63	57	60	
"	b	40	40	40	84	23	39	31	86	37	27	32	92
"	c	13	7	10		10	10	10		0	3	2	
"	d	7	6	6		6	3	4		0	13	6	
Scotland, E.	a	47	57	52		53	52	55		63	63	63	
"	b	37	30	34	86	39	22	31	86	30	20	25	88
"	c	13	3	8		3	13	8		7	7	7	
"	d	3	10	6		0	13	6		0	10	5	
England, N.E.	a	60	60	60		74	48	61		67	60	64	
"	b	27	30	29	89	20	26	23	84	27	30	28	92
"	c	10	3	6		3	16	10		3	3	3	
"	d	3	7	5		3	10	6		3	7	5	
England, E.	a	47	60	54		71	58	65		60	70	65	
"	b	30	30	30	84	23	23	23	88	33	13	23	88
"	c	20	10	15		0	6	3		7	10	9	
"	d	3	0	1		6	13	9		0	7	3	
Midland Cos.	a	50	67	59		74	32	53		67	70	69	
"	b	40	27	33	92	20	45	33	86	30	17	23	92
"	c	10	3	7		0	10	5		3	10	7	
"	d	0	3	1		6	13	9		0	3	1	
England, S.	a	47	63	55		74	32	53		77	77	77	
"	b	30	27	29	84	16	36	26	79	17	10	14	91
"	c	20	10	15		3	19	11		6	7	6	
"	d	3	0	1		7	13	10		0	6	3	
Scotland, W.	a	30	57	44		68	48	58		60	64	62	
"	b	47	23	35	79	29	26	28	86	27	20	24	86
"	c	17	7	12		3	13	8		10	3	6	
"	d	6	13	9		0	13	6		3	13		
England, N.W.	a	27	70	49		78	49	64		70	53	62	
"	b	50	23	36	85	16	29	22	86	20	27	23	85
"	c	17	0	9		6	6	6		7	10	9	
"	d	6	7	6		0	16	8		3	10	6	
England, S.W.	a	47	67	57		65	65	65		60	70	65	
"	b	43	27	35	92	29	23	26	91	30	14	22	87
"	c	3	0	2		6	6	6		3	3	3	
"	d	7	6	6		0	6	3		7	13	10	
Ireland, N.	a	53	63	48		61	58	60		57	53	55	
"	b	44	27	36	84	29	26	27	87	30	30	30	85
"	c	13	0	6		3	3	3		7	7	7	
"	d	10	10	10		7	13	10		6	10	8	
Ireland, S.	a	43	70	57		65	52	59		63	64	64	
"	b	37	23	30	87	19	26	22	81	23	23	23	87
"	c	13	0	6		13	6	10		7	3	5	
"	d	7	7	7		3	16			7	10	8	
Summary.													
British Isles	a	43	62	53		68	49	59		64	64	64	
"	b	39	23	33	86	24	29	26	85	23	21	25	89
"	c	13	4	9		5	10	8		5	6	5	
"	d	5	6	5		3	12	7		3	9	6	

England, south coast.—Bognor, Ryde, Ventnor (2), Gorey (Jersey), Haslar Hospital, Poole, Exmouth, Weymouth, Portland, Budleigh Salterton, Cawsand, Mevagissey, Gorranhaven, Devoran, Portscath, Penryn, Durgan, Porthallow, Falmouth, Coverack, Newlyn, Mousehole.

England, south-west coast.—St. Ives, Hayle, Padstow, Port Isaac, Boscastle, Highbridge, Weston-super-Mare.

Wales.—Briton Ferry, Swansea, Angle, Milford, Abersoch.

England, north-west coast.—Fleetwood, Morecambe, Maryport.

Isle of Man.—Douglas, Port St. Mary, Peel.

Scotland, south-west coast.—Port Patrick, Stranraer.

Ireland, east coast. — Cushendall, Belfast, Bangor, Groomsport, Donaghadee, Ardglass, Carlingford, Greenore, Dundalk, Malahide, Howth, Kingstown (2), Bray, Wicklow.

Ireland, south coast.—Dunmore, Dungarvan, Crosshaven, Kinsale, Union Hall, Castletownsend, Baltimore, Schull, Crookhaven.

Ireland, west coast.—Valencia, Dingle, Tralee, Tarbert, Kilcredane, Barna, Elly Bay, Ballyglass, Ballycastle (Co. Mayo), Donegal, Tribane, Killybegs, Teelin, Portnoo, Burton Port, Bunbeg.

Ireland, north coast.—Dunfanaghy, Rathmullen, Buncrana, Moville, Portrush, Portstewart.

Scotland, west coast.—Tarbert, Campbeltown, Carradale, Portree (Isle of Skye), Plockton.

Hebrides.—Stornoway, Cromore, Babyle, Obb, Ness.

SUMMARY of STATIONS supplied with INSTRUMENTS.

England and Wales - - - - - -	66
Scotland - - - - - - -	55
Ireland - - - - - - -	46
	167

APPENDIX X.

TELEGRAPHIC WEATHER INTELLIGENCE.

The following stations are supplied with telegraphic information of storms, free of expense, and signal "cones" have been furnished to most of them, all further expenses attendant on the maintenance and repair of the apparatus being borne locally. The stations are situated,

84 in England and Wales, 41 in Scotland, 15 in Ireland, 3 in the Isle of Man, and 3 in the Channel Islands.

NORTH.	WEST.	SOUTH.	EAST.
SCOTLAND. EAST COAST.	ENGLAND, N.W.	ENGLAND, S.W.	ENGLAND, E.
Dunrossness.	Ramsey.	Ilfracombe.	Eyemouth.
Lerwick.	Douglas.	Appledore.	Berwick-on-Tweed.
Scalloway.	Castletown.	Boscastle.	Tynemouth.
Stromness.	Silloth.	Port Isaac.	S. Shields.
Kirkwall.	Maryport.	Newquay.	Sunderland.
Holborn Head.	Workington.	Hayle.	Middlesborough.
Wick.	Whitehaven.	Scilly.	Redcar.
Inverness.	Barrow.	St. Sennen.	Whitby.
Nairn.	Morecambe.	St. Just.	Filey.
Burghead.	Fleetwood.	Penzance.	Bridlington Quay.
Lossiemouth.	Blackpool.	Falmouth.	Hull.
Buckie.	Lytham.	Pendennis.	Goole.
Port Knockie.	Southport.	Mevagissey.	Grimsby.
Portsoy.	Runcorn.	Plymouth.	Boston.
Banff.	Liverpool.	Teignmouth.	Sutton Bridge.
Cullen.	ENGLAND, W.	Exmouth.	Lynn.
Fraserburgh.	Connah's Quay.		Sheringham.
Peterhead.	Port Penrhyn.		Cromer.
Aberdeen.	Holyhead.		
Stonehaven.	Port Dinorwic.		
Montrose.	Carnarvon.		
Broughty Ferry.	Aberystwith.	ENGLAND, S.	ENGLAND, S.E.
St. Andrews.	Milford.	Guernsey.	Yarmouth.
Dundee.	Pembrey.	St. Helier's (Jersey).	Southwold.
Bo'ness.	Llanelly.	Gorey (Jersey).	Ipswich.
Grangemouth.	Swansea.	Weymouth.	Harwich.
Anstruther.	Briton Ferry.	Poole.	Chatham.
Pittenweem.	Porthcawl.	Cowes.	Sheerness.
Burntisland.	Penarth.	Ryde.	Faversham.
Granton.	Cardiff.	Portsmouth.	
Newhaven.	Newport.	Littlehampton.	
Leith.	Weston-super-Mare.	Brighton.	
Fisherrow.	Burnham.	Newhaven.	
Dunbar.		Hastings.	
Cockburnspath.	IRELAND, E.	Rye.	
	Belfast.	Sandgate.	
	Donaghadee.	Folkestone.	
	Howth.	Dover.	
FIRTH OF CLYDE.	Kingstown.	Margate.	
Glasgow.	IRELAND, S. and W.		
Greenock.	New Ross.		
Rothesay.	Dunmore East.		
Campbelton.	Dungarvan.		
Girvan.	Youghal.		
Ballantrae.	Queenstown.		
	Passage.		
	Kinsale.		
	Cork.		
	Tralee.		
	Limerick.		
	Galway.		

The signals used consist of:—

1. Cone, point downwards for Southerly gales; S.E. round by S. to N.W.
2. Cone, point upwards for Northerly gales; N.W. round by N. to S.E.

The signals are to be kept hoisted *during the daylight only*, until 48 hours have elapsed from the time *the telegram was despatched*, unless countermanded. At night, lanterns may be used wherever the local authorities deem it desirable to do so.

The meaning of the signals is that an atmospherical disturbance exists (which will be explained in the telegram), and will probably, but not *necessarily*, cause a gale at the place warned, *from the direction* indicated by the signal.

The Meteorological Office supplies the canvas shapes and lanterns to such places as require them, on loan, but in all cases the local authorities must undertake the charges incidental to the hoisting of the signal, such as flagstaff and gear, oil, &c., and also to the keeping of the apparatus in repair, painting, &c.

APPENDIX XI.

REPORT ON THE COMPARISON OF THE FORECASTS ISSUED AT 8h. 30m. p.m. WITH THE WEATHER SUBSEQUENTLY EXPERIENCED, for the 12 Months, April 1887 to March 1888.

The letters used have the following signification:—

a = complete success.	**c** = partial failure.
b = partial (more than half) success.	**d** = total failure.

The checking has been conducted on the same system as that employed in previous years, *i. e.*, each forecast has been considered under the separate headings of "Wind" and "Weather," but the results of the 8 p.m. Forecasts only are here published.

The first column gives the percentage of success in "Wind," the second in "Weather," and the third the average of the two.

The Summary for the whole year is given at page 11.

Districts.		April 1887. Percentages. Wind.	Weather.	Average.	a+b.	May 1887. Percentages. Wind.	Weather.	Average.	a+b.	June 1887. Percentages. Wind.	Weather.	Average.	a+b.
Scotland, N.	a	40	47	44		61	48	55		63	57	60	
"	b	40	40	40	84	23	39	31	86	37	27	32	92
"	c	13	7	10		10	10	10		0	3	2	
"	d	7	6	6		6	3	4		0	13	6	
Scotland, E.	a	47	57	52		58	52	55		63	63	63	
"	b	37	30	34	86	39	22	31	86	30	20	25	88
"	c	13	3	8		3	13	8		7	7	7	
"	d	3	10	6		0	13	6		0	10	5	
England, N.E.	a	60	60	60		74	48	61		67	60	64	
"	b	27	30	29	89	20	26	23	84	27	30	28	92
"	c	10	3	6		3	16	10		3	3	3	
"	d	3	7	5		3	10	6		3	7	5	
England, E.	a	47	60	54		71	58	65		60	70	65	
"	b	30	30	30	84	23	23	23	88	33	13	23	88
"	c	20	10	15		0	6	3		7	10	9	
"	d	3	0	1		6	13	9		0	7	3	
Midland Cos.	a	50	67	59		74	32	53		67	70	69	
"	b	40	27	33	92	20	45	33	86	30	17	23	92
"	c	10	3	7		0	10	5		3	10	7	
"	d	0	3	1		6	13	9		0	3	1	
England, S.	a	47	63	55		74	32	53		77	77	77	
"	b	30	27	29	84	16	36	26	79	17	10	14	91
"	c	20	10	15		3	19	11		6	7	6	
"	d	3	0	1		7	13	10		0	6	3	
Scotland, W.	a	30	57	44		68	48	58		60	64	62	
"	b	47	23	35	79	29	26	28	86	27	20	24	86
"	c	17	7	12		3	13	8		10	3	6	
"	d	6	13	9		0	13	6		3	13		
England, N.W.	a	27	70	49		78	49	64		70	53	62	
"	b	50	23	36	85	16	29	22	86	20	27	23	85
"	c	17	0	9		6	6	6		7	10	9	
"	d	6	7	6		0	16	8		3	10	6	
England, S.W.	a	47	67	57		65	65	65		60	70	65	
"	b	43	27	35	92	29	23	26	91	30	14	22	87
"	c	3	0	2		6	6	6		3	3	3	
"	d	7	6	6		0	6	3		7	13	10	
Ireland, N.	a	53	63	48		61	58	60		57	53	55	
"	b	44	27	36	84	29	26	27	87	30	30	30	85
"	c	13	0	6		3	3	3		7	7	7	
"	d	10	10	10		7	13	10		6	10	8	
Ireland, S.	a	43	70	57		65	52	59		63	64	64	
"	b	37	23	30	87	19	26	22	81	23	23	23	87
"	c	13	0	6		13	6	10		7	3	5	
"	d	7	7	7		3	16			7	10	8	

Summary.

British Isles	a	43	62	53		63	49	59		64	64	64	
"	b	39	28	33	86	24	29	26	85	28	21	25	89
"	c	13	4	9		5	10	8		5	6	5	
"	d	5	6	5		3	12	7		3	9	6	

Districts.		July 1887. Percentages. Wind.	Weather.	Average.	a+b.	August 1887. Percentages. Wind.	Weather.	Average.	a+b.	September 1887. Percentages. Wind.	Weather.	Average.	a+b.
Scotland, N.	a	65	36	51		55	65	60		53	47	50	
"	b	26	32	29	80	29	13	21	81	27	33	30	80
"	c	6	16	11		13	19	16		13	17	15	
"	d	3	16	9		3	3	3		7	3	5	
Scotland, E.	a	61	52	57		42	45	44		37	40	39	
"	b	29	29	29	86	49	36	42	86	40	50	45	84
"	c	10	10	10		6	13	10		17	10	13	
"	d	0	9	4		3	6	4		6	0	3	
England, N.E.	a	58	48	53		68	58	63		50	43	47	
"	b	42	36	39	92	23	32	28	91	33	33	33	80
"	c	0	13	7		6	7	6		10	17	13	
"	d	0	3	1		3	3	3		7	7	7	
England, E.	a	45	58	52		62	52	57		54	53	54	
"	b	45	13	29	81	32	32	32	89	30	27	28	82
"	c	10	16	13		3	6	5		13	17	15	
"	d	0	13	6		3	10	6		3	3	3	
Midland Cos.	a	61	58	60		61	55	58		50	67	59	
"	b	36	16	26	86	32	32	32	90	27	20	23	82
"	c	3	10	6		7	3	5		20	10	15	
"	d	0	16	8		0	10	5		3	3	3	
England, S.	a	42	48	45		65	55	60		50	54	52	
"	b	42	26	34	79	26	39	33	93	30	30	30	82
"	c	16	23	20		6	0	3		17	13	15	
"	d	0	3	1		3	6	4		3	3	3	
Scotland, W.	a	61	45	53		49	39	44		33	44	39	
"	b	26	39	33	86	45	39	42	86	40	43	41	80
"	c	7	10	8		6	3	5		20	10	15	
"	d	6	6	6		0	19	9		7	3	5	
England, N.W.	a	65	58	62		48	45	47		43	60	52	
"	b	23	29	26	88	39	23	31	78	20	27	23	75
"	c	6	10	8		10	6	8		27	10	19	
"	d	6	3	4		3	26	14		10	3	6	
England, S.W.	a	58	48	53		58	40	54		57	53	55	
"	b	26	26	26	79	20	19	19	73	23	27	25	80
"	c	6	16	11		19	6	13		10	10	10	
"	d	10	10	10		3	26	14		10	10	10	
Ireland, N.	a	42	42	42		42	55	49		27	50	39	
"	b	45	32	39	81	32	20	30	79	37	37	37	76
"	c	13	13	13		16	6	11		23	10	16	
"	d	0	13	6		10	10	10		13	3	8	
Ireland, S.	a	39	39	39		55	49	52		33	40	37	
"	b	35	39	37	76	23	29	26	78	33	47	40	77
"	c	23	16	20		13	6	10		17	3	10	
"	d	3	6	4		9	16	13		17	10	13	

Summary.

British Isles	a	54	48	51		55	52	54		44	50	47	
"	b	34	29	32	83	32	29	30	84	31	34	33	80
"	c	9	14	11		10	7	9		17	12	14	
"	d	3	9	6		3	12	7		8	4	6	

Districts.		October 1887. Percentages. Wind.	Weather.	Average.	a+b.	November 1887. Percentages. Wind.	Weather.	Average.	a+b.	December 1887. Percentages. Wind.	Weather.	Average.	a+b.
Scotland, N.	a	58	68	63		47	43	45		39	39	39	
"	b	29	23	26	89	37	43	40	85	29	45	37	76
"	c	7	3	5		13	7	10		32	10	21	
"	d	6	6	6		3	7	5		0	6	3	
Scotland, E.	a	65	74	70		47	34	41		35	39	37	
"	b	26	16	21	91	33	40	36	77	26	45	36	73
"	c	6	3	4		17	13	15		29	16	22	
"	d	3	7	5		3	13	8		10	0	5	
England, N.E.	a	61	68	65		47	43	45		42	48	45	
"	b	32	23	27	92	33	30	32	77	32	42	37	82
"	c	7	3	5		17	17	17		20	10	15	
"	d	0	6	3		3	10	6		6	0	3	
England, E.	a	50	65	58		33	37	35		36	52	44	
"	b	50	26	38	96	43	47	45	80	58	35	47	91
"	c	0	9	4		17	10	14		6	3	4	
"	d	0	0	0		7	6	6		0	10	5	
Midland Cos.	a	50	61	56		43	20	32		35	45	40	
"	b	43	23	33	89	37	67	52	84	42	35	39	79
"	c	7	13	10		17	7	12		23	10	16	
"	d	0	3	1		3	6	4		0	10	5	
England, S.	a	64	68	66		50	54	52		39	55	47	
"	b	33	19	26	92	40	33	37	89	48	26	37	84
"	c	3	10	7		3	10	6		13	10	12	
"	d	0	3	1		7	3	5		0	9	4	
Scotland, W.	a	35	29	32		50	50	50		35	39	37	
"	b	39	49	44	76	37	33	35	85	26	26	26	63
"	c	23	3	13		10	10	10		29	19	24	
"	d	3	19	11		3	7	5		10	16	13	
England, N.W.	a	55	65	60		43	47	45		42	49	46	
"	b	32	26	29	89	30	30	30	75	23	35	29	75
"	c	10	3	7		27	13	20		26	10	18	
"	d	3	6	4		0	10	5		9	6	7	
England, S.W.	a	55	58	57		52	58	55		58	55	57	
"	b	39	42	40	97	28	21	25	80	23	26	24	81
"	c	6	0	3		17	7	12		6	16	11	
"	d	0	0	0		3	14	8		13	3	8	
Ireland, N.	a	27	39	33		35	72	54		52	35	44	
"	b	47	45	46	79	34	14	24	78	16	45	30	74
"	c	20	10	15		17		15		23	10	17	
"	d	6	6	6		14		7		9	10	9	
Ireland, S.	a	50	42	46		35	48	42		39	55	47	
"	b	33	45	39	85	34	31	32	74	32	35	34	81
"	c	17	0	9		17	11	14		16	0	8	
"	d	0	13	6		14	10	12		13	10	11	
Summary.													
British Isles	a	52	58	55		44	46	45		41	47	44	
"	b	37	31	34	89	35	35	35	80	32	36	34	78
"	c	9	5	7		16	11	14		20	10	15	
"	d	2	6	4		5	8	6		7	7	7	

Districts.		January 1888. Percentages. Wind.	Weather.	Average.	a+b.	February 1888. Percentages. Wind.	Weather.	Average.	a+b.	March 1888. Percentages. Wind.	Weather.	Average.	a+b.
Scotland, N.	a	45	48	47		35	52	44		55	71	63	
"	b	39	39	39	86	52	31	41	85	23	26	25	88
"	c	10	10	10		3	14	9		13	3	8	
"	d	6	3	4		10	3	6		9	0	4	
Scotland, E.	a	58	65	62		45	41	43		45	61	53	
"	b	23	32	27	89	31	38	35	78	13	32	23	76
"	c	13	0	7		14	14	14		23	0	11	
"	d	6	3	4		10	7	8		19	7	13	
England, N.E.	a	64	78	71		52	52	52		42	71	57	
"	b	23	16	20	91	23	35	32	84	36	20	28	85
"	c	13	3	8		10	3	6		3	3	3	
"	d	0	3	1		10	10	10		19	6	12	
England, E.	a	65	58	62		45	52	49		42	52	47	
"	b	26	26	26	88	45	28	36	85	32	29	31	78
"	c	9	13	11		10	3	7		7	16	11	
"	d	0	3	1		0	17	8		19	3	11	
Midland Cos.	a	49	61	55		48	45	47		35	52	44	
"	b	32	23	28	83	28	45	36	83	32	29	30	74
"	c	16	16	16		21	7	14		23	16	20	
"	d	3	0	1		3	3	3		10	3	6	
England, S.	a	68	65	67		42	66	54		36	55	46	
"	b	29	32	30	97	41	27	34	88	35	32	33	79
"	c	0	0	0		17	7	12		16	3	10	
"	d	3	3	3		0	0	0		13	10	11	
Scotland, W.	a	42	58	50		45	41	43		26	52	39	
"	b	48	26	37	87	41	28	35	78	35	22	29	68
"	c	10	10	10		7	21	14		29	13	21	
"	d	0	6	3		7	10	8		10	13	11	
England, N.W.	a	58	71	65		59	48	54		32	71	52	
"	b	39	10	24	89	24	31	27	81	42	13	27	79
"	c	3	10	7		10	14	12		13	10	12	
"	d	0	9	4		7	7	7		13	6	9	
England, S.W.	a	49	55	52		41	55	48		65	58	62	
"	b	39	26	33	85	52	28	40	88	16	23	19	81
"	c	6	16	11		7	14	11		13	6	10	
"	d	6	3	4		0	3	1		6	13	9	
Ireland, N.	a	55	61	58		50	52	56		35	58	47	
"	b	16	23	20	78	24	31	27	83	23	29	26	73
"	c	19	10	14		14	17	16		19	7	13	
"	d	10	6	8		3	0	1		23	6	14	
Ireland, S.	a	58	58	58		66	52	59		48	39	44	
"	b	19	29	24	82	21	35	28	87	10	39	24	68
"	c	13	13	13		10	10	10		23	9	16	
"	d	10	0	5		3	3	3		19	13	16	
Summary.													
British Isles	a	56	62	59		49	51	50		42	58	50	
"	b	30	26	28	87	35	32	34	84	27	27	27	77
"	c	10	9	10		11	11	11		17	8	13	
"	d	4	3	3		5	6	5		14	7	10	

APPENDIX XII.

LIST of STATIONS from which DAILY SIMULTANEOUS OBSERVATIONS (at 0h. 8m. p.m. G. M. T.) have been received in 1886.

Stations.	Observers.	Remarks.
ENGLAND AND WALES.		
Bradford - -	J. McLandsborough, F.R.A.S., F.R. Met. Soc. and A. E. Preston, F.R. Met. Soc.	—
Chatham, School of Military Engineering.	Percy McHugo, Bugler, R.E.	—
Falmouth Observatory -	The Staff.	—
Greenwich Observatory -	The Staff, for the Astronomer Royal.	—
Guernsey - -	A. Collenette, F.R. Met. Soc.	—
Kew Observatory -	The Staff.	—
Leicester (Museum) -	J. C. Smith.	—
Liverpool Observatory (Bidston).	J. Hartnup, F.R. Met. Soc.	—
Oxford, Radcliffe Obs. -	The Staff.	—
Plymouth - -	J. Merrifield, LL.D., F.R.A.S.	—
Stonyhurst Observatory -	The Staff.	—
SCOTLAND.		
Aberdeen Observatory -	The Staff.	—
Orkney, Swanbister -	W. I. Fortescue.	—
IRELAND.		
Galway, Queen's College	W. Ryan.	—
Valencia Observatory -	The Staff.	—
BRITISH COLONIES, POSSESSIONS, &C.		
Barbados, W. I. - -	Surgeon-Maj. in charge.	—
Gibraltar - -	Surgeon-Gen. in charge.	—
Malta - - -	R. R. Willan.	—
Nassau (Bahamas) -	J. A. Kerr	—
Natal - - -	Surgeon-Maj. in charge.	—
Scutari, British Cemetery	Serg. W. H. Lyne, R.E.	—
Sierra Leone - -	Surgeon-Maj. in charge.	—

SUMMARY.

—	—
England and Wales -	11
Scotland - - -	2
Ireland - - -	2
British Colonies and Possessions - -	7
Total	22

APPENDIX XIII.

METHODS FOLLOWED IN DEALING WITH METEOROLOGICAL RETURNS FROM LAND STATIONS IN THE BRITISH ISLES.

These stations are of five classes, as stated on page 18.

I.—*Observatories continuously observing all the Meteorological Elements.*

Returns from observatories.

Hourly measurements of the curves obtained from the self-recording instruments at the observatories of the Office are made by the observers at each station, on printed forms supplied for the purpose, which, together with the curves, are forwarded to the Office weekly. They comprise measurements of the barograms, of the dry-bulb and wet-bulb thermograms, of the anemograms, and of the rain-gauge curves.

Examination of returns.

The measurements are subjected to a careful examination in order to ensure as far as possible their accuracy, and the regulations which have been adopted to secure this end are in the main the same as those which will be found in the Report of the Office for 1868. They comprise rules for the guidance of observers, as well as of the assistants charged with the examination of the work at the Office. Attention need be called here to only two of these rules, viz.: (*a*) the use of subsidiary sheets on which are entered the results of a second set of measurements of the curves, made after, and quite independently of, the first set, and with a different scale, the two sets of measurements being afterwards compared together, and any differences found inquired into and set right; and (*b*) the re-measurements of the curve made by the assistants at the Meteorological Office, and which always amount to 40, and in doubtful cases to many more, per month, for each element.

Results of examination and report to Council.

The attention of the observers is always drawn to such errors as may be detected, and to any failures in the continuity of the curves arising from failure of the light, stoppage of the clock, defective photography, faulty action of the wet-bulb thermometer, &c.; a report containing the results of the examination of each Observatory being also submitted to the Council periodically. The curves and tabulations are eventually bound and stored in the Office.

General supervision of observatory work.

In connexion with this work should be mentioned the general watch which has to be kept over the working of the observatories and of the instruments, not only to secure uniformity amongst them and observance of rules, but also to guard against small changes which are liable to occur at certain times, especially with the thermographs, and which may affect the scale-values of the instrument or the datum lines used for the tabulation of the curves. About twice a year this work calls for special examination, entailing some considerable time and occasionally the engraving of new scales for measuring the curves.

Harmonic analyser.

The photographic curves are also used in the harmonic analyser; and for this purpose the barograms require a slight special preparation.

METHOD OF DEALING WITH THE NUMERICAL RESULTS FROM THE SELF-RECORDING OBSERVATORIES.

Interpolations.

In dealing with the tabulations the first step is to go over the sheets and fill up by interpolation, wherever possible, any gaps or breaks in the continuity of the record.

Means.

The record having been made as complete as possible, the daily, five-daily, and monthly means of the barometer and of the dry-bulb and wet-bulb thermometers are deduced.

Vapour tension.

The hourly vapour tension is then computed by an expansion of Glaisher's Hygrometrical Tables, prepared in the Office, and the work is independently checked.

A copy is next prepared of the above-mentioned hourly measurements of the barometer, dry-bulb and wet-bulb thermometers, wind and rain curves, and of the computed values of vapour tension. To these are added the daily means of the three first-mentioned elements, the extremes and daily range of pressure and temperature, and the daily totals of rainfall, and the whole series is printed and published under the title of "Hourly Readings from the Self-recording Instruments "at the Four Observatories under the Meteorological Council." Hourly Readings.

To ensure accuracy the sheets are read over in proof with the original measurements of the curves. The interpolated readings are printed in *italic* type, but no distinguishing mark is affixed to means which are partly based on them. When the gap in the record is too long to be dealt with by an interpolation of the missing hourly readings, the mean for the day is obtained either from the maximum and minimum readings for the day, or by an interpolation from the adjacent daily means, and the result thus obtained is printed as an approximation.

The five-daily, monthly, and annual means, together with the absolute extremes of pressure and temperature for each month, are printed as part of the "Hourly Readings." The tables are repeated in French measures. Annual Tables.

The gale tables printed in the text of the Quarterly Weather Report, which show the extent, duration, and degree of severity of all the stronger gales, are prepared from the tabulations of the anemograms received from the self-recording observatories, together with those received from the extra anemographic stations. Tables for the Quarterly Weather Reports. Gale tables.

II.—*Anemographic Stations at which the Wind is recorded continuously.*

The anemograms received from the stations enumerated on page 108 are regularly examined and tabulated in the Office, and the sheets bound up in volumes. Besides special inquiries on legal and other points that from time to time arise, and in which these documents are of high importance, the tabulations are always employed in the preparation of the summary of weather and gale tables for the Quarterly Weather Report. They are also regularly used in the checking of the Storm Warnings issued by the Office.

III.—*Method followed with regard to the Returns from Land Stations of the Second Order.*

Ever since the year 1866 returns of more or less completeness have been received from land stations in the United Kingdom. In that year there was only one station, but by 1871 the number had increased to 15, and five years later to 49, including 14 stations belonging to the Royal Meteorological Society, copies of the returns from which were sent to the Office under a special arrangement with the Society. Origin and progress of system.

At the end of the present year the total number of stations was 77, including 15 belonging to the Royal Meteorological Society and 5 belonging to the Scottish Meteorological Society.

This number is exclusive of the self-recording observatories, and of the anemographic stations, but it includes several from which only very scanty information is received.

The stations are distributed as follows: 43 in England, 3 in Wales, 12 in Scotland, and 19 in Ireland.

The returns are received at the Office monthly, and are duly entered and stored.

The publication of the returns is carried out in the following way: For a certain number of stations the observations of pressure (to the Publication on Form A.

second place of decimals), temperature, wind, cloud amount, and weather, at 9 a.m. and 9 p.m. each day, together with the computed vapour tension and relative humidity at those hours, and the daily maxima and minima of temperature, and daily rainfall, are published *in extenso* on the Form, A., proposed by the Permanent Committee of the First International Meteorological Congress at Vienna in 1874, and adopted for international use by the Second International Meteorological Congress at Rome in 1879.

The Permanent Committee assigned an inferior limit to the number of stations from which returns should be published *in extenso*, varying from 2 for Belgium to 100 for Russia in Asia, the number in the case of the United Kingdom being 15. In 1875, when the systematic publication of returns from Stations of the Second Order began, the results from only nine stations in connexion with the Office were available, but this number has steadily grown, until for 1880 returns from 33 stations were published on the A. Form. Though this list could be extended if desired, it has been thought better to curtail it somewhat on account of the size of the publication. The volume for 1883, the last published, contains therefore, like that for 1881 and 1882, returns, *in extenso*, from only 30 stations. The volume for 1884, however, which is now passing through the press, will contain returns from 32 stations.

Additions to the list for publication.

Care is taken in adding to the list for publication to see, first, that the station is satisfactory as regards its instruments, their exposure, &c.; secondly, that the returns bear internal evidence of accuracy and care in their preparation; and thirdly, that the district represented by the station is one for which information is needed.

Examination.

Full particulars as to the methods adopted in the examination of the returns will be found in previous reports.

Publication on Form B.

Besides this publication in full, the monthly means of the various elements, together with summaries of the wind direction and of the weather, are published on the Form B., also devised by the Permanent Committee of the Vienna Congress, and adopted by the Roman Congress.

Returns from six stations were published in this manner for the year 1873, and from nine stations for the year 1874. In 1875 the list included the names of 26 stations. This number has grown to 46 for the year 1884, and might be even further increased.

All the stations, returns from which are published *in extenso* on Form A., are included in the Form B. list. But this list also includes others, either not quite so good, not so representative, or not so long established. The method of preparation is in the main the same as in the case of the Form A. But the summaries of wind and weather for all the stations are specially prepared for this publication. For wind, the summary shows the number of *observations* at 9 a.m. and 9 p.m. under each of the semi-quadrantal points N., N.E., E., &c., the observations under intermediate points being thrown alternately forward and backward. For weather, the summary gives the number of *days* of rain, snow, hail, thunderstorm, clear sky, overcast, and gale. The days of clear sky and overcast are those when the means of the cloud-amounts at 9 a.m. and 9 p.m. are less than 2, and more than 8 respectively. The days of gale are those when force 7 or upwards, by Beaufort scale, is recorded.

British rainfall.

The monthly rainfall values (total, number of rainy days, and maximum) for the observatories and all the Stations of the Second Order are supplied each year to Mr. Symons, F.R.S., for publication in his "British Rainfall."

Unpunctual observations.

The observations are taken at 9 a.m. and 9 p.m. local time each day. It sometimes happens, however, that strict punctuality cannot be observed. In such cases, if the difference in time does not exceed 30 minutes, the

observations are, in most cases, printed without alteration. When the difference exceeds 15 minutes, a note is inserted in the remarks showing the exact time of observation. If the difference in time is more than half-an-hour, the readings are usually rejected and an interpolation made.

New stations. When an application for the adoption of a new station is received, a schedule is forwarded to the observer containing a series of questions as to the outfit of the station, the exposure of the instruments, and the influence likely to be exerted on their indications by surrounding objects, such as houses and trees. Only mercurial barometers are accepted, and only such as have been duly verified. All thermometers must have been tested at Kew. A plan of the station, showing the positions of the instruments with regard to neighbouring objects is also required.

On the return of this schedule the answers are considered, and, where necessary, alterations are advised.

If, however, the existing arrangements are satisfactory, tables for reducing the barometer readings to 32° Fahrenheit at mean sea level are prepared and duplicates sent to the observer, together with a set of Hygrometrical Tables, and a copy of "Instructions in the Use of Meteorological Instruments."

The first returns are compared and examined with special care, and a report of the result of the examination is forwarded to the observer, with instructions how best to complete and perfect the returns.

Sunshine records. The daily records of sunshine which are now received from 35 Stations in the British Islands are examined generally to guard against accidental changes in the adjustment of the instruments. Notes explaining any omission or accidental defect are added to the cards if required, and after their receipt has been acknowledged, they are duly stamped and dated and then stored in the Office.

Weekly totals. A tabulation of these curves is published as part of the Weekly Weather Report, mentioned in Appendix VII., and for those stations which are also Stations of the Second Order the monthly totals of bright sunshine in hours, together with the percentage of its possible duration, is published as Part IV. of "Returns from Stations of the Second Order." A table showing the daily amount of sunshine at Bunhill Row, one of the London stations, is also prepared quarterly for the Royal Meteorological Society.

Inspection.

The Stations of the Second Order are regularly inspected, the attention of the inspector being directed by the Office to any special point which may require investigation.

IV.—*Telegraphic Reporting Stations.*

Full particulars relating to these stations, the information received from them, and the method of dealing with that information, will be found in Appendix VII. A paragraph in that Appendix (p. 85) explains the use that is made of the monthly schedules sent in by the observers.

V.—*Extra Stations.*

No returns from Stations of the Fifth Class are published by the Office, but some of them are regularly used in the checking of the Storm-Warnings, and all are available for any special investigation that may be taken up.

The rainfall values at these stations are, however, copied and supplied to Mr. Symons, F.R.S., for publication in "British Rainfall."

APPENDIX XIV.

List of Documents relating to the Land Meteorology of the British Islands, received during the Year ending March 31st, 1888.

	Stations.	Observers.	Nature of Information received.	Notes.
I.	†Valencia	J. E. Cullum	Continuous records of pressure, temperature, wind, sunshine, and rain, with eye observations of the clouds and notes on the weather.	
	Glasgow	Prof. R. Grant, M.A., LL.D., F.R.S.		
	†Aberdeen	Prof. C. Niven, M.A., F.R.S.		
	†Falmouth	E. Kitto, F.R. Met. Soc.		
	†Stonyhurst	Rev. S. J. Perry, S.J., F.R.S.		
	†Kew	G. M. Whipple, B.Sc., F.R.A.S., F.R. Met. Soc.		
II.	†Armagh	J. L. E. Dreyer, Ph.D., F.R.A.S.	Continuous record of wind, rainfall, and sunshine.	
	Alnwick Castle	Lt.-Col. F. Holland, for the Duke of Northumberland, K.G.	Continuous record of wind (direction and velocity).	
	Dublin (Phœnix Park)	Lt.-Col. A. B. Coddington, R.E.	" "	From December 1887.
	Fleetwood	M. S. Gaulter, C.E.	" "	
	†Holyhead	Hugh Williams, C.E.	" "	
	†North Shields	Capt. W. Harrison	" "	
	†Swanbister (Orkney)	W. I. Fortescue, Esq.	" "	
	†Scilly	W. Thomas	" "	
	†Yarmouth	G. T. Watson	" "	
	Heligoland	J. J. Friederichs	" "	From September 1887.
	†Kilkenny Castle	The Marquis of Ormonde	Continuous record of pressure.	
	†Waterford	The Harbour Authorities	" "	
III.	†Armagh	J. L. E. Dreyer, Ph.D., F.R.A.S.	Regular observations at 9 a.m. and 9 p.m. of pressure, temperature (dry-bulb and wet-bulb), wind, cloud and weather, with the daily maxima and minima of temperature, the daily rainfall, and general remarks on the weather.	
	Aysgarth	Rev. Fenwick W. Stow, M.A., F.R. Met. Soc.		
	Babbacombe, Devon	E. E. Glyde, F.R. Met. Soc.		
	Bennington, Herts.	Rev. J. Dunne Parker, LL.D., F.R. Met. Soc.		
	†Braemar	James Aitken, J.P.		
	†Brookeborough (Colebrooke Park).	W. Ferguson, for Sir Victor Brooke, Bt., F.L.S.		
	†Buxton	E. J. Sykes, M.B., F.R.A.S., F.R. Met. Soc.		

LIST OF DOCUMENTS—*continued.*

Stations.	Observers.	Nature of Information received.	Notes.
M Carmarthen - -	G. J. Hearder, M.D. - - - -	Regular observations at 9 a.m. and 9 p.m. of pressure, temperature (dry-bulb and wet-bulb), wind, cloud and weather, with the daily maxima and minima of temperature, the daily rainfall, and general remarks on the weather.	
M †Cheadle - -	J. C. Philips, Esq. - - - -		
M Cheltenham - -	R. Tyrer, B.A., F.R. Met. Soc. - -		
M Churchstoke - -	Philip Wright, F.C.S., F.R. Met. Soc. -		
†Cronkbourne, Isle of Man.	A. W. Moore, M.A., J.P. - - -		
†Douglas, Isle of Man	Thos. Keig, Esq. - - - -		
†Dublin (Botanic Gardens, Glasnevin).	F. W. Moore, M.R.I.A. - - -		
†Dublin (City) -	J. W. Moore, M.D., F.R. Met. Soc. - -		
†Dublin (Mountjoy Observatory).	Sergt. Lipscombe, for Lt.-Col. A. B. Coddington, R.E., Ordnance Survey Office.		
S †Dundee - -	W. Ross McKelvie, Esq. - - -		
S †Dunrobin Castle -	D. Melville, for the Duke of Sutherland, K.G.		
†Durham - -	H. J. Carpenter, Esq. - - - -		
†Eastbourne - -	R. Sheward, Esq., F.R. Met. Soc. - -	- - - - - -	From July 1887.
†Edgeworthstown -	J. M. Wilson, J.P. - - - -	- - - - - -	From January 1888.
†Epsom (Royal Med. College).	J. S. Jackson, Esq. - - - -		
†Geldeston (Beccles) -	E. T. Dowson, F.R. Met. Soc. - -		
Glasgow - -	Prof. R. Grant, M.A., LL.D., F.R.S. - -		
†Glenalmond - -	Arthur S. Reid, M.A., F.G.S. - -		
M Hillington, Norfolk -	Rev. H. E. B. Ffolkes, M.A., F.R. Met. Soc. -		
M Killarney - -	The Ven. Archdeacon G. R. Wynne, M.A., F.R. Met. Soc.		
†Laudale (Argyleshire)	A. Fletcher, for T. H. G. Newton, M.A., J.P., F.R. Met. Soc.		
†Leicester - -	J. C. Smith, for Museum Authorities - -		
M Llandudno - -	J. Nicol, M.D., J.P., F.R. Met. Soc. - -		

LIST OF DOCUMENTS—*continued.*

Stations.	Observers.	Nature of Information received.	Notes.
†Londonderry	J. Conroy, F.R. Met. Soc.	Regular observations at 9 a.m. and 9 p.m. of pressure, temperature (dry-bulb and wet-bulb), wind, cloud and weather, with the daily maxima and minima of temperature, the daily rainfall, and general remarks on the weather.	
Margate	J. Stokes, F.R. Met. Soc.		
†Market Rasen	W. B. Jevons, Esq.		From May 1887.
†Markree Castle, Sligo	A. Marth, F.R.A.S., for Col. Cooper, F.R.A.S.		
Marlborough	C. E. B. Hewitt, B.A., F.R. Met. Soc.		
Newton Reigny (Penrith).	T. G. Benn, F.R. Met. Soc.		
†Parsonstown	O. Boeddicker, Ph.D., for the Earl of Rosse, F.R.S.		
†Pinmore	Peter Donald		
†Prestwich (Manchester)	T. R. H. Clunn, M.D., F.R. Met. Soc.		
†Rothesay	James Kay, Esq.		
†Scarborough	Allan Rowntree, F.R. Met. Soc.		
†Seaham	G. H. Aird		
Southampton	J. T. Cook, R.E., for Director General of the Ordnance Survey.		
Southbourne	T. A. Compton, B.A., M.D., F.R. Met. Soc.		
Stokesay	Miss M. A. Digges La Touche		
†Stonyhurst	Rev. S. J. Perry, S.J., F.R.S.		
†St. David's, Pembroke	W. P. Propert, LL.D., F.G.S., F.R. Met. Soc.		
†St. Leonards	H. Colborne, M.R.C.S.		
†Swanbister	W. I. Fortescue, Esq.		
Uppingham	Rev. G. H. Mullins, M.A., F.R. Met. Soc.		
Uttoxeter	Rev. R. Barker, F.R. Met. Soc.		From October 1887.
†Wakefield	H. Clarke, L.R.C.P., F.S.S., F.R. Met. Soc.		
†York	J. Wright, for H. M. Platnauer, F.G.S.		
IV. The Telegraphic Stations, see List on page 63		Regular observations twice (and in some cases three times) daily of pressure, temperature, wind, weather, and sea disturbance.	
V. Arlington Court, Devon	J. Carter, for Lady Chichester	Pressure, temperature (dry-bulb, wet-bulb, max., min.), wind and rainfall, once daily.	
Baltimore	J. Halsey	Pressure, temperature, wind, and weather, once daily.	

LIST OF DOCUMENTS—*continued.*

Stations.	Observers.	Nature of Information received.	Notes.
Castletownsend -	Lieut. T. W. Cobb, R.N. - - -	Pressure and temperature four times daily, and wind twice daily.	
Crookhaven - -	" " - - - -		
Chatham (School of Military Engineering).	P. McHugo, for Instructor in Surveying -	Full return for 9 a.m.	
Cooper's Hill (Egham)	Prof. H. McLeod, F.R.S. - - -	Full return for 9 a.m. and 3 p.m.	
Crosshaven - -	J. W. Bridle - - - -	Pressure, temperature, and wind, twice daily.	
Cuckfield -	John Howe, Esq. - - - -	Daily rainfall. - - - -	From October 1887.
Ennis - -	J. Hill, C.E., F.R. Met. Soc. - - -	Daily rainfall.	
Galway - -	E. G. Shaw - - - - -	Pressure and temperature four times daily, with wind.	From February 1888.
Gorleston, Norfolk -	R. J. C. Day - - - - -	Pressure and wind twice daily.	
Harpenden - -	T. Wilson, F.R. Met. Soc. - - -	Pressure, temperature, and wind, twice daily, with rainfall.	
Haslar - -	G. Coppen - - - - -	Pressure and temperature four times daily.	
Knightstown (Valencia).	John Doughty - - - -	Pressure, wind, and weather once daily -	From September 1887.
Rugby - -	C. H. Hodges, M.A., Geo. M. Seabrooke, F.R.A.S., and W. N. Wilson, M.A.	Full set of 9 a.m. observations with 9 p.m. temperatures.	
Saffron Walden -	J. G. Bellingham - - - -	Pressure and temperature twice daily, with 9 a.m. wind and rainfall.	
Schull - -	Lieut. T. W. Cobb, R.N. - - -	Pressure, temperature, and wind twice daily.	
†Sheffield (Weston Park)	Elijah Howarth, F.R.A.S. - - -	Full returns for 9 a.m. and 6 p.m.	
Stamford (Ketton Hall)	Fred. Coventry, Esq. - - - -	Full monthly summary.	
Stranraer - -	P. Doran - - - - -	Pressure, wind, and weather once daily -	From February 1888.
Sudbury - -	W. Bayley Ransom - - - -	Pressure, temperature (dry-bulb, max., min.), wind, cloud, and rainfall, once daily, with general remarks.	
Symbister, Shetland -	J. S. Nicolson - - - -	Pressure and temperature twice daily.	
Tarbert (Harris) -	Donald Bethune - - - -	Pressure and wind twice daily.	
Union Hall - -	Lieut. T. W. Cobb, R.N. - - -	Pressure, temperature, and wind, twice daily.	

NOTE.—The Stations marked "℞" belong to the Royal Meteorological Society; those marked "♆" belong to the Scottish Meteorological Society; those marked thus † have been inspected during the year.

LIST of STATIONS from which CONTINUOUS RECORDS of BRIGHT SUNSHINE have been received.

Station.	Observer.
Aberdeen	Prof. C. Niven, M.A., F.R.S.
Armagh	J. L. E. Dreyer, Ph.D., F.R.A.S.
Blackpool	J. Wolstenholme, F.R. Met. Soc.
Cambridge	H. Todd.
Churchstoke	P. Wright, F.C.S, F.R. Met. Soc.
Cirencester	Prof. Ohm., B.A., F.R. Met. Soc.
Cronkbourne, Isle of Man	A. W. Moore, M.A., J.P.
Cullompton	Thos. Turner, J.P., F.R. Met. Soc.
Dublin	A. B. Coddington, Lt. Col. R.E.
Durham	H. J. Carpenter.
Falmouth	E. Kitto, F.R. Met. Soc.
Geldeston, Beccles	E. T. Dowson, F.R. Met. Soc.
Glasgow	Prof. R. Grant, M.A., LL.D., F.R.S.
Hastings	H. Colborne, M.R.C.S.
Hillington	Rev. H. E. B. Ffolkes, M.A., F.R. Met. Soc.
Jersey (Noirmont)	J. Fisher.
Kew Observatory	G. M. Whipple, B.Sc., F.R.A.S.
Leicester	J. C. Smith.
Llandudno	J. Nicol, M.D., J.P., F.R. Met. Soc.
London, Bunhill Row	Messrs. de la Rue.
„ Westminster	The Staff, Meteorological Office.
Marchmont	P. Loney.
Markree Castle	A. Marth, F.R.A.S.; for Col. E. H. Cooper.
Newton Reigny (Penrith)	T. G. Benn, F.R. Met. Soc.
Oswald Kirk, Yorkshire	R. Thompson.
Oxford	E. J. Stone, F.R.S.
Parsonstown	O. Boeddicker, Ph.D.; for the Earl of Rosse, F.R.S.
Plymouth	J. Merrifield, LL.D., F.R.A.S.
St. Ann's Head	S. Blake.
Southampton	Sir C. Wilson, Col. R.E., K.C.B., F.R.S.
Stonyhurst	Rev. S. J. Perry, M.A., F.R.S.
Stornoway	John Forbes.
Swanbister (Orkney)	W. Irvine Fortescue.
Valencia	J. E. Cullum.
Worksop	H. Mellish, F.R. Met. Soc.
York	J. E. Clarke, B.A., B.Sc.

In addition, the number of hours sunshine recorded each day is reported from the following Stations :—

Braemar	J. A. Aitken.
Ingatestone	L. J. Petre, F.R. Met. Soc.
Stowell	Rev. H. J. Poole, F.R. Met. Soc.

APPENDIX XIVa.

LIST of DOCUMENTS relating to the Meteorology of various Colonial and Foreign Military Stations, received from the Office of the Ordnance Survey in 1879, and from the Army Medical Department in 1886, and now being prepared for publication.

District.	Station.	Observations made by	Period.	Total No. of Sheets.
NORTH AMERICA AND NORTH ATLANTIC.	New Westminster (B. Columbia).	R.E.	1860–1861	2
	Newfoundland - -	R.E.	1852–1862	11
	Newfoundland - -	A.M.D.	1866–1870	5
	Quebec - - -	R.E.	1853–1861	6
	Quebec - - -	A.M.D.	1866–1870	5
	Halifax - - -	R.E.	1852–1862	11
	Halifax - - -	A.M.D.	1866–1875	9
	Kingston - -	R.E.	1853–1861	9
	Bermuda - -	R.E.	1852–1862	11
	Bermuda - -	A.M D.	1866–1884	19
MEDITERRANEAN -	Gibraltar - -	R.E.	1852–1862	11
	Gibraltar - -	A.M.D.	1866–1884	19
	Malta - - -	R.E.	1852–1861	9
	Malta - - -	A.M.D.	1866–1884	19
	Corfu - - -	R.E.	1852–1861	10
	Scutari - - -	A.M.D.	1866–1884	19
WEST INDIES -	Bahamas - -	R.E.	1852–1862	11
	Bahamas - -	A.M.D.	1866–1884	18
	Jamaica (Newcastle) -	A.M.D.	1866–1884	19
	Jamaica (Up Park Camp)	R.E.	1852–1861	10
	Jamaica (Up Park Camp)	A.M.D.	1866–1884	19
	Honduras - -	A.M.D.	1866–1870	5
	Barbados - -	R.E.	1853–1862	10
	Barbados - -	A.M.D.	1866–1884	19

District.	Station.	Observations made by	Period.	Total No. of Sheets.
West Coast of Africa and South Atlantic.	Bathurst - - -	A.M.D.	1869	1
	Sierra Leone - -	A.M.D.	1874–1884	11
	Sierra Leone - -	General Lawson.	1847–1851	5
	Sierra Leone (night obs.)	General Lawson.	1849–1851	3
	St. Helena - -	R.E.	1853–1862	10
South Africa -	Natal - - -	A.M.D.	1868–1884	17
	Grahamstown - -	R.E.	1853–1862	10
	Grahamstown - -	A.M.D.	1867–1870	4
	Capetown - -	A.M.D.	1870–1875	6
Indian Ocean -	Trincomalee - -	A.M.D.	1865–1875	11
	Kandy - - -	A.M.D.	1866–1875	10
	Colombo - -	R.E.	1852–1862	11
	Colombo - -	A.M.D.	1866–1875	10
	Newera Eliya - -	A.M.D.	1866–1872	7
	Singapore - -	A.M.D.	1868–1884	16
	Mauritius - -	R.E.	1852–1861	10
	Mauritius (night obs.) -	R.E.	1852–1861	10
China - -	Hong Kong - -	R.E.	1853–1862	10
	Hong Kong - -	A.M.D.	1866–1884	19
Australasia -	Freemantle - -	R.E.	1852–1859	5
	Auckland - -	R.E.	1853–1862	10
	Auckland - -	A.M.D.	1866–1869	4

APPENDIX XV.

ACCESSIONS TO THE LIBRARY DURING THE YEAR ENDING 31ST MARCH 1888.

A—AGRICULTURE AND BOTANY.

* **Drude, O.**—Atlas der Pflanzenverbreitung. (Berghaus' Physikalischer Atlas, Abteilung v.) 6 pp., 8 charts, f°. Gotha, 1887.

Ufficio centrale di Meteorologia, Roma.—Rivista Meteorico-Agraria. Anno viii., 1887, Nos. 1-36. la. 8°. (Roma, 1887-88.)

‖ **Wollny, E.**—Forstlich-meteorologische Beobachtungen. 34 pp. 8°. (*Forschungen auf dem Geb. Agrik.-phys., Heidelberg, Bd.* x., *Heft* 4/5.)

‖ ———.— Untersuchungen über das Verhalten der atmosphärischen Niederschläge zur Pflanze und zum Boden. 26 pp. 8°. (*Forschungen auf dem Geb. Agrik.-phys., Heidelberg, Bd.* x., *Heft* 1/2.)

‖ ———.—Untersuchungen über den Einfluss der Pflanzendecke und der Beschattung auf die physikalischen Eigenschaften des Bodens. Zweite Mittheil. 84 pp. 8°. (*Forschungen auf dem Geb. Agrik.-phys., Heidelberg, Bd.* x., *Heft* 4/5.)

‖ ———.—Untersuchungen über die Temperaturverhältnisse des Bodens bei verschiedener Neigung des Terrains gegen die Himmelsrichtung und gegen den Horizont. (Nachträge.) 20 pp., 8°. (*Forschungen auf dem Geb. Agrik.-phys., Heidelberg, Bd.* x., *Heft* 4/5.)

B—ASTRONOMY.

‖ **Exner, K.**—Ueber die Scintillation. 66 pp. la. 8°. (*Exner's Repert.*, xxiii., pp. 371 *u.* 426.)

Government Observatory, Madras.—Results of observations of the fixed stars made with the meridian circle at the Government Observatory, Madras, in the years 1862, 1863 and 1864, under the direction of **N. R. Pogson.** xlvii. + 314 pp. 4°. Madras, 1887.

‖ **Grant, R.**—The proper motions of the stars. Read . . . 5th Nov. 1884. 14 pp. 8°. (*Proc. Phil. Soc. Glasgow.*)

‖ **Marangoni, C.**—L'ecclisse totale di luna del 4–5 Ottobre 1884. 13 pp. la. 8°. Firenze, 1885. (*Riv. scient.-industr.*)

* **(Nautical Almanac Office.)** — The nautical almanac and astronomical ephemeris for the year 1888, for the meridian of the Royal Observatory at Greenwich. xi. + 515 + 13 pp., 8°. London, 1884.

Royal Astronomical Society, London.—Memoirs. Vol. xlix., Part i. 1 vol., 4°. London, 1888.

———.—Monthly Notices . . . From November 1886 to November 1887. Vol. xlvii., with plates, 8°. London, 1887.

Royal Observatory, Greenwich.—Report of the Astronomer Royal to the Board of Visitors of the Royal Observatory, Greenwich, read at the annual visitation of the Royal Observatory, 1887, June 4. (By **W. H. M. Christie.**) 22 pp. la. 4°. s.l.e.a.

United States Naval Observatory.—Observations made during the year 1883, at the United States Naval Observatory. Rear-Admiral R. W. Shufeldt, Superintendent. 1 vol., with plates, la. 4°. Washington, 1887.

Venturi, A.—Di una notevole semplificazione nel calcolo delle perturbazioni dei piccoli pianeti. Pubbl. R. Osserv. Brera in Milano, N. xxviii. 15 pp. sm. f°. Milano, 1886.

NOTE.—Books marked * have been acquired by purchase; the others are donations from institutions, societies, or authors. Those marked ‖ are excerpt papers, extra copies of which have been separately printed.

In some cases additional publications have been received besides those specified, but only completed volumes or years are given here.

Warner Observatory, Rochester, N.Y.—History and work. 1883–1886. vol 1. 70 pp., 3 plates, 8°. Rochester, N.Y., 1887.

C—ATMOSPHERIC PRESSURE.

* || **Broun, J. A.**—On simultaneous variations of the barometer in India. 16 pp. 8°. [*Proc. R. Soc.*, xxv., 1876, *p.* 24.]

* || ———.—Supplementary note on simultaneous barometric variations. 5 pp., 1 plate, 8°. [*Proc. R. Soc.*, xxv., 1876, *p.* 39.]

Hann, J.—Die Vertheilung des Luftdruckes über Mittel- und Süd-Europa dargestellt auf Grundlage der 30 jährigen Monats- und Jahres-Mittel 1851–80, nebst allgemeinen Untersuchungen über die Veränderlichkeit der Luftdruck-Mittel- und -Differenzen sowie deren mehrjährige Perioden. Geograph. Abhandl. herausgegeben von Prof. Dr. A. Penck in Wien. Bd. II. Heft 2. vi. + 220 pp., 3 plates, la. 8°. Wien, 1887.

[Hazen], H. A.—Barometer exposure. 8°. slip. [*Science*, 1887, *Apl.* 29.]

|| **Hazen, H. A.**—On the projection of lines of equal pressure in the United States, west of the Mississippi River. 12 pp. la. 8°. (*Amer. Journ. Sc.*, xxi., 1881, *May*, *p.* 361.)

|| ———.—On the reduction of air-pressure to sea-level, and the determination of elevations by the barometer. Read at the April Meeting of the Conn. Acad. and Sc. 9 pp. la. 8°. (*Amer. Journ. Sc.*, 3*rd ser.*, xxi., 1881, *June*, *p.* 453.)

|| ———.—On the retardation of the maxima and minima of air-pressure at high stations. 9 pp. la. 8°. (*Amer. Journ. Sc.*, xxiv., 1882, *Aug.*, *p.* 105.)

|| **(Hazen, H. A.)**—Reduction of air pressure to sea level. 12 pp., 1 plate, 8°. (*Amer. Meteor. Journ.*, 1887, *June*.)

* || **Howard, L.**—On the barometrical variation as affected by the moon's declination. Read June 19, 1845. 7 pp. la. 4°. (*Phil. Trans.*, 1846, *p.* 441.)

|| **Monaco, S. A. le Prince Albert de.**—Sur des courbes barométriques enregistrées pendant la troisième campagne scientifique de l'Hirondelle. 5 pp. 4°. (Paris, 1888.) [*Compt. rend. acad. sc., Paris*, cvi., 1888, *p.* 177.]

|| **Ragona, D.**—Andamento diurno della pressione atmosferica dedotto da un ventennio di rilievi del barometro registratore del R. Osservatorio di Modena. Dicembre. 61 pp., 3 plates, sm. f°. Roma, 1887. (*Annal. Meteor. Ital.*, vii., 1885, *parte* 1.)

D—AURORA.

* || **De La Rive, A.**—Nouvelles recherches sur les aurores boréales et australes et description d'un appareil qui les reproduit avec les phénomènes qui les accompagnent. 29 pp. la. 4°. Genève, 1862. (*Mém. Soc. phys. hist. nat. Genève*, xvi., 2*e partie*.)

* **Lemström, S.**—L'aurore boréale. Étude générale des phénomènes produits par les courants électriques de l'atmosphère. xiii. + 199 pp., 14 plates, la. 8°. Paris, 1886.

E—BIBLIOGRAPHY.

New York State Library.—Annual report of the Trustees . . . for the years 1884–86. 67th to 69th. 3 vols. la. 8°. Albany, 1885–87.

F—CLIMATE AND HYGIENE.

* || **Frankland, E.**—Climate in town and country. Read Feb. 10, 1882. 11 pp. 8°. [*Proc. R. Inst. Gt. Brit.*, x., *No.* 75, *p.* 17.]

* || **Gordon, C. A.**—Remarks on climate in relation to organic nature. 37 pp. 8°. London, s.a. [*Trans. Vict. Inst., London*, xvii.]

|| **Grimshaw, T. W.**—On the prevalence and distribution of phthisis and other diseases of the respiratory organs in Ireland. 28 pp., 4 plates, 8°. Dublin, 1887. (*Trans. Acad. Med. Ireland*, v.)

* **Harwood, W.**—On the curative influence of the Southern coast of England; especially that of Hastings: with observations on diseases in which a residence on the coast is most beneficial. viii. + 326 pp. sm. 8°. London, 1828.

Hinrichs, G.—The climate of southern Russia and Iowa compared. A climatological study on the transplantation of Russian fruit to Iowa and the Upper Mississippi Valley. 16 pp. la. 8°. [*Amer. Meteor. Journ.*, iv., 1888, *p.* 460.]

* **Hough, J.**—Letters on the climate, inhabitants, productions, &c., &c., of the Neilgherries, or Blue Mountains of Coimbatoor, South India. iv. + 172 pp. 8°. London, 1829.

Inspector General of Customs, Peking.—Medical reports for the half-years ended 30th September 1886 and 31st March 1887. 32nd and 33rd Issues. 2 vols., with plates, 4°. Shanghai, 1886–87.

Lima, J. A. de.—Breve noticia sobre o clima da cidade do Rio Grande do Sul. 16 pp. 8°. (*Rev. Soc. geogr. Rio de Janeiro*, II., 1886, *p.* 277.)

* **Lindsay, J. A.**—The climatic treatment of consumption. A contribution to medical climatology. xii. + 228 pp. sm. 8°. London, 1887.

* **Mackness, J.**—Hastings considered as a resort for invalids. With tables, illustrative of its temperature, salubrity, and the general character of the climate, showing its suitability in pulmonary and other diseases. Also, directions for the choice of a residence, and hints as to diet, regimen, bathing, &c. xii. + 151 pp. sm. 8°. London, 1842.

Nicol, J.—The climate of Llandudno. Second edition. 35 pp., 3 plates, sm. 8°. London, 1885.

Physiographical Commission of the I. R. Academy of Science at Cracow.—Materials for Galician climatology, collected by the Meteorological section . . . 1886. 297 pp. la. 8°. Cracow, 1887. (*Extract Rep. Physiogr. Comm.*)

In the Polish language.

Registrar General, London.—Weekly return of births and deaths in London and in twenty-seven other great towns. Vol. xlviii., 1887. Nos. 1–52. la. 8°. London, 1887.

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——.—Weekly returns of births and deaths in Dublin (including its suburban districts), and in fifteen of the principal urban sanitary districts in Ireland, 1887. Vol. XXIV. la. 8°. Dublin, 1888.

(Sanitary Commissioner, Punjab.)—Report on the Sanitary Administration of the Punjab for the year 1886. 1 vol., with plates, f°. Lahore, 1887.

(Scott, R. H.)—Is climate changing ? 7 pp. 8°. [*Longman's Mag.*, xi., 1888, *Mch.*, *p.* 535.]

* **Shapter, T.**—The climate of the south of Devon; and its influence upon health: with short accounts of Exeter, Torquay, Babbicombe, Teignmouth, Dawlish, Exmouth, Budleigh-Salterton, Sidmouth, &c. x. + 258 pp., 1 plate, sm. 8°. London, 1842.

Société de Médecine et de Climatologie de Nice.—Nice-Médical. 11e Année, 1886–87, Nos. 1–12. la. 8°. Nice, 1886–87.

‖ **(Tacchini, P.)**—Sul clima di Massaua. 21 pp. sm. f°. Roma, 1888. (*Annal. Meteor. Ital.*, 1886, *parte* i.)

* **Where to take a holiday.**—Reports on some home and foreign health resorts. The holiday number of the London Medical Record. July 1, 1887. 102 pp. la. 8°. London, 1887.

* **Williams, J.**—The climate of Great Britain; or remarks on the change it has undergone, particularly within the last fifty years. Accounting for the increasing humidity and consequent cloudiness and coldness of our springs and summers; . . . . Including various experiments to ascertain the causes of such change. ix. + 358 pp. 8°. London, 1806.

G—EARTHQUAKES.

Denza, F.—Alcune notizie sul terremoto del 23 febbraio 1887. 56 pp., 1 plate, sm. 8°. Torino, 1887.

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* **(Proctor, R. A.)**—Earthquakes in England. 11 pp. 8°. [*Longman's Mag.*, iv., *No.* xxii., *p.* 382.]

* **Shaler, N. S.**—The stability of the earth. 21 pp. la. 8°. (*Scribner's Mag.*, I., 1887, *Mch., p.* 259.)

* **Wark, —.**—Method of determining the strength and direction of earthquakes. 3 pp. 8°. (*Essays obsns. Phil. Soc. Edinb.*, iii., 1771, *p.* 142.)

H—ELECTRICITY AND MAGNETISM.

* || **Chambers, C.**—On the luni-solar variations of magnetic declination and horizontal force at Bombay, and of declination at Trevandrum. Read April 1, 1886. 43 pp, 5 plates, la. 4°. London, 1887. (*Phil. Trans.*, clxxviii., 1887, *A., p.* 1.)

|| **Colladon, D.**—Renseignements sur un coup de foudre d'une intensité très exceptionnelle. Séance du 25 avril 1887. 6 pp. 4°. (*Compt. rend. acad. sc., Paris, t.* civ.)

|| ———.—Sur les origines du flux électrique des nuages orageux. Séances des 12 et 19 avril 1886. 13 pp. 4°. (*Compt. rend. acad. sc., Paris, t.* cii.)

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|| **Falmouth Observatory.**—Falmouth Observatory magnetographs. 12 pp. 8°. Falmouth, 1887. (*Ann. Rep. R. Cornw. Polyt. Soc.*, 1886.)

|| **Ferrari, C.**—Risultati ottenuti dalle ricerche del Dr. Ciro Ferrari sulle osservazioni dei temporali raccolte nel 1882–1883. 78 pp., 10 plates, sm. f°. Roma, 1887. (*Ann. Meteor. Italiana*, vii., *Parte* 1, 1885.)

Fornioni, C.—Osservazione meteorologiche orarie ottenute da strumenti registratori durante l'anno 1882. Pubbl. R. Osserv. di Brera in Milano, N. xxvii. 55 pp., 6 plates, sm. f°. Milano, 1885.

* **Franklin, B.**—Letter from Dr. B. Franklin to D. Hume, Esq., on the method of securing houses from the effects of lightning. With report by Prof. **Russel.** 13 pp. 8°. (*Essays obsns. Phil. Soc. Edinb.*, iii., 1771, *p.* 129.)

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|| **Hazen, H. A.**—Thunderstorms and their relations to "low." Abstract. la. 8°. Sheet. (*Proc. Amer. assoc. advanc. sc.*, xxxiii., 1884.)

|| **Holborn, L.**—Resultate aus den Beobachtungen der magnetischen Deklination, welche während der Jahre 1844 bis 1886 zu Klausthal angestellt sind. 20 pp. la. 8°. (*Nachr. k. Gesellsch. Wissensch. Georg-Aug. Univ. Göttingen*, 1887, *No.* 16, *p.* 469.)

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|| **(Lang, C.)**—Fortpflanzungsgeschwindigkeit der Gewitter in Süddeutschland. Vorläufige Mittheilung. 9 pp. la. 4°. [*Beob. meteor. Stationen K. Bayern*, viii., 1886, *p.* xlvi.]

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‖ **Luvini, G.**—Perturbazione elettrica foriera del terremoto. 7 pp. la. 8°. (Firenze, 1887.) (*Riv. scient.-industr.*)

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‖ **Meyer, H.**—Die Gewitter zu Göttingen in den Jahren 1857–1880. 12 pp., 1 plate, la. 8°. (*Nachr. k. Gesellsch. Wissensch. Göttingen*, 1887. *No.* 9, *p.* 290.)

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* **Naumann, E.**—Die Erscheinungen des Erdmagnetismus in ihrer Abhängigkeit vom Bau der Erdrinde. iv. + 78 pp., 1 chart, la. 8°. Stuttgart, 1887.

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Tifliser physikalisches Observatorium.—Magnetische Beobachtungen . . . in den Jahren 1884–1885. Herausgegeben von **J. Mielberg.** lx. + 80 + 80 pp. la 8°. Tiflis, 1887.

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‖ **Weber, L.**—Mittheilungen, betreffend die im Auftrage des Elektrotechnischen Vereins ausgeführten Untersuchungen über Gewittererscheinungen und Blitzschutz. Vortrag gehalten in der Sitz. des Elektrotechn. Ver. am 26 Okt. 1886. 8° pp. la. 8°. (*Elektrotechn. Zeitschr.*, 1886, *Nov.*)

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Perrier, F., Perrotin, I., Celoria, G.—Operazioni eseguite nell' anno 1881 per determinare la differenza delle longitudini fra gli osservatori del Dépot Général de la Guerre a Montsouris presso Parigi, del Mont Gros presso Nizza, di Brera in Milano. Resoconto delle operazioni fatte da G. Celoria. Pubbl. R. Osserv. di Brera in Milano. N. xxix. 96 pp. sm. f°. Milano, 1887.

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Rajna, M.—Azimut assoluto del segnale trigonometrico del Monte Palanzone sull' orizzonte di Milano determinato nel 1882. Pubbl. R. Osserv. di Brera in Milano. N. xxxi. 127 pp. sm. f°. Milano, 1887.

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Phillpotts, Rev. Canon.—Notes on an extraordinary hailstorm at Porthgwidden &c. [March 31, 1886]. 5 pp. 8°. (*Rep. R. Cornw. Polyt. Soc.*, 1886, *p.* 89.)

K—HYDRAULICS, HYDROLOGY, AND TIDES.

Admiralty, London.—Tide tables for the British and Irish Ports, for the year 1888; also the times and heights of high water at full and change for the principal places on the Globe. Computed by Staff Captain **H. R. Harris.** vi. + 238 pp. la. 8°. London, (1887).

|| **Elson, S. R.**—The changes observed in the density of the surface sea-water at the Sandheads. 18 pp., 1 plate, 8°. Calcutta, 1887. (*Journ. Asiatic Soc. Bengal*, lvi., *part* ii., 1887.)

Greenwood, W. N.—Kludonometric tide tables for the Lancashire coast, shewing the time of high water and height of tide at Glasson Dock and Lancaster, on the river Lune; also Fleetwood and Liverpool; with a table of corrections for the atmospheric disturbance of the tide height, and other useful information. 1888. viii. + 24 + 86 pp., 7 plates, sm. 8°. Lancaster, [1887.]

———.—The history of a wave from its cradle to its grave. Read before the Lancaster Phil. Soc. Newspaper cutting. (*Lancaster Guardian*, 1888, *Mch.* 24.)

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|| ———.—Résumé des observations centralisées . . . . . pendant l'année 1886, par **G. Lemoine,** sous la direction de **E. Allard,** et avec le concours de **Ch. Lallemand.** 59 pp. la. 8°. Versailles, 1887. (*Ann. soc. météor. France*, xxxvi., 1888, *Fév.*)

|| **Tripp, W. B.**—South African Rivers south of the Orange and Vaal. 12 pp. 8°. London, 1887. (*Min. Proc. Inst. Civ. Engin.*, xc., 1886–87, *Part* iv.)

|| **Warington, R.**—A contribution to the study of well waters. A report of experiments made in the Rothamsted laboratory. 53 pp., 7 plates, 8°. London 1887. (*Journ. Chem. Soc.*, li., 1887, *p.* 500.)

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|| **Abercromby, Hon. R.**—Modern developments of cloud knowledge. Being an address delivered . . . . March 30, 1887. 16 pp. la. 8°. [*Journ. Scott. Meteor. Soc.*, viii., *3rd ser.*, *p.* 3.]

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* **Bureau central météorologique de France.**—Atlas de météorologie maritime publié à l'occasion de l'exposition maritime internationale du Havre. vi. + 36 pp., 21 plates, la. 4°. Paris, 1887.

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* **Mason, M.**—Aeronautics; or, sketches illustrative of the theory and practice of aerostation: comprising an enlarged account of the late aerial expedition to Germany. vii. + 355 pp., 6 plates, 8°. London, 1838.

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APPENDIX XVI.

METEOROLOGICAL OFFICE: ACCOUNT of RECEIPTS and PAYMENTS for the year ending 31st March 1888.

RECEIPTS.

	£ s. d.	£ s. d.
Balance from year 1886–87		2,382 8 9
Parliamentary Vote		15,300 0 0
Repayment of expenses charged under—		
(1.) Incidental expenses	14 18 1	
(2.) Special researches	14 7 8	
		29 5 9
SUPPLY OF INFORMATION:		
D.W. Charts and Forecasts	243 2 4	
6 p.m. Charts	25 0 0	
Information for Press Agencies, &c.	101 0 8	
Telegrams	241 19 8	
		611 2 8
SALE OF INSTRUMENTS, &c.:		
Royal Navy (A)	3 8 0	
Mercantile Marine account (B)	16 11 9	
		19 19 9
Commissions executed for Colonial and Foreign Institutions, &c. (C)		276 1 11
Commission charged on work done for Colonies, &c.		8 11 10
		£18,627 10 8

PAYMENTS.

	£ s. d.	£ s. d.
ADMINISTRATION:		
Payment of Council	1,000 0 0	
Secretary	800 0 0	
Salaries and wages	806 15 6	
Rent, fuel, and lighting	716 2 7	
Incidental and contingent expenses:—		
Attendance, cleaning, &c.	373 15 2	
Furniture and fittings	98 4 8	
Pensions	42 16 4	
		3,837 14 3
SPECIAL RESEARCHES		773 7 3
LAND METEOROLOGY:		
Observatories and stations	1,874 11 2	
Salaries: — Discussion and reduction of observations	1,299 18 0	
		3,174 9 2
WEATHER INFORMATION AND FORECASTS:		
Telegraphic reports and storm warnings	2,720 0 4	
Salaries:— Preparation and issue of reports and forecasts	1,659 13 3	
		4,379 13 7
INSPECTIONS:		
Salaries and travelling expenses		524 10 4
OCEAN METEOROLOGY:		
Salaries: —Discussion and reduction of observations	1,884 6 0	
Expenses incidental to the supply of instruments:—		
Proportion for care and issue of instruments	200 0 0	
Royal Navy	277 17 0	
Mercantile Marine	257 18 5	
Distant island and coast stations	79 13 7	
		2,699 15 0
Commissions executed for Colonial and Foreign Institutions, &c.		276 16 2
BALANCE:		
Cash at Bank	2,893 9 6	
„ at Office	67 15 5	
		2,961 4 11
		£18,627 10 8

APPENDIX XVII.

LIST OF PUBLICATIONS, &c. issued under the Authority of the Meteorological Council.

OFFICIAL.

No. 1. Report for 1867. Presented to Parliament. 1*s.*
2. Instructions for Meteorological Telegraphy. New Edition. (1883.) 6*d.*
3. Fishery Barometer Manual. (New edition, 1887.) 6*d.*
4. Charts of Surface Temperature, South Atlantic Ocean. 2*s.* 6*d.*
5. Report for 1868. Presented to Parliament. 5*d.*
6. Report for 1869. Presented to Parliament. 10*d.*
7. Quarterly Weather Report for 1869.—Parts I. to IV. 5*s.* each.
8. Barometer Manual. (Out of print, see Nos. 3, 24, 40, 60, and 61.)
9. Quarterly Weather Report for 1870.—Parts I. to IV. 5*s.* each.
10. Report for 1870. Presented to Parliament. 10*d.*
*11. Contributions to our Knowledge of the Meteorology of Cape Horn and the West Coast of South America. 2*s.* 6*d.*
*12. Currents and Surface Temperature of the North Atlantic Ocean, from the Equator to Lat. 40° N., for each month of the year, with a General Current Chart. 2*s.* 6*d.*
13. A Discussion of the Meteorology of the Part of the Atlantic lying North of 30° N., for the Eleven Days ending 8th February 1870. Price, with Book of Charts, 5*s.*
14. Quarterly Weather Report for 1871.—Parts I. to IV. 5*s.* each.
15. Report for 1871. Presented to Parliament. 10*d.*
16. Quarterly Weather Report for 1872.—Parts I. to IV. 5*s.* each.
17. Report for 1872. Presented to Parliament. 1*s.*
18. Contributions to our Knowledge of the Meteorology of the Antarctic Regions. 2*s.*
19. Quarterly Weather Report, 1873.—Parts I. to IV. 5*s.* each.
20. Charts of Meteorological Data for Square 3. Lat. 0°—10° N. Long. 20° — 30° W., and Remarks to accompany the Monthly Charts, which show the Best Routes across the Equator for each Month, &c. 20*s.*
21. Report of the Proceedings of the Meteorological Congress at Vienna. 1*s.*
22. Report for 1873. Presented to Parliament. 4*d.*
23. Report of the Proceedings of the Conference on Maritime Meteorology held in London, 1874. 2*s.*
24. Instructions in the Use of Meteorological Instruments. [Reprinted 1888.] 2*s.* 6*d.*
25. Quarterly Weather Report for 1874.—Parts I., II., and IV. 5*s.* each. Part III., 5*s.* 9*d.*
26. Report for 1874. Presented to Parliament. 6*d.*

* The Meteorological Council have given away the copies which were placed at their disposal, but they can be purchased from the Publishers.

LIST OF PUBLICATIONS, &c.—*continued.*

No. 27. Charts of Meteorological Data for the Nine 10° Squares of the Atlantic which lie between 20° N. and 10° S., and extend from 10° to 40° W., with accompanying Remarks, ending with the Best Routes across the Equator. 24*s.*

28. Contributions to our Knowledge of the Meteorology of Japan. By Staff-Commander Thomas H. Tizard, H.M.S. *Challenger.* 1*s.*

29. Report for 1875. Presented to Parliament. 4*d.*

30. Quarterly Weather Report for 1875.—Parts I.—IV. 5*s.* each.

31. Report for 1876–7. Presented to Parliament. 3*s.* 5*d.*

32. A Discussion of the Meteorology of the North Atlantic during August 1873, with 31 Synoptic Charts. 15*s.*

33. Quarterly Weather Report for 1876 (New Series).—Part I., 6*s.*; Parts II., III., and IV., 5*s.* each.

*34. Contributions to our Knowledge of the Meteorology of the Arctic Regions. Vol. I.,—Part I., 2*s.*; Part II., 10*s.*; Part III., 6*s.*; Part IV., 5*s.*; Part V., 6*s.*

35. Report for 1877–8. Presented to Parliament. 1*s.*

36. Report of the Proceedings of the Meteorological Congress at Rome, 1879. 1*s.* 6*d.*

37. Report on the Meteorology of Kerguelen Island. By the Rev. S. J. Perry, S.J., F.R.S. 3*s.*

38. Report for 1878–9. Presented to Parliament. 5*d.*

39. Meteorological Observations at Stations of the Second Order for the year 1878. 20*s.*

40. Aids to the Study and Forecast of Weather, by the Rev. W. Clement Ley, M.A. 1*s.*

41. Report for 1879–80. Presented to Parliament. 1*s.*

42. Report for 1880–81. Presented to Parliament. 1*s.* 2*d.*

43. Charts of Meteorological Data for the Ocean District adjacent to the Cape of Good Hope, with accompanying Remarks. Price of the Charts, 25*s.*; of the Remarks, 7*s.*

44. Report on the Gales experienced in the Ocean District adjacent to the Cape of Good Hope, between Lat. 30° and 50° S., and Long. 10° and 40° E., by Capt. H. Toynbee. 7*s.* 6*d.*

45. Meteorological Observations at Stations of the Second Order for the year 1879. 20*s.*

46. Report on the Storm of October 13–14, 1881. By Robert H. Scott, F.R.S. 1*s.* 6*d.*

47. Rainfall Tables of the British Isles for 1866–80. Compiled by G. J. Symons, F.R.S. 7*s.* 6*d.*

48. Report for 1881–2. Presented to Parliament. 1*s.*

49. Quarterly Weather Report for 1879. (New Series.) Appendices and Plates. 27*s.* Parts I., II., and III., 6*s.* each. (Part IV., in the Press.)

50. Quarterly Weather Report for 1880. (New Series.) Appendices and Plates. 28*s.*

51. Hourly Readings, 1881. (New Series.) Part I., 10*s.* 6*d.* Parts II., III., and IV., 21*s.* each.

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LIST OF PUBLICATIONS, &c.—*continued.*

No. 52. Quarterly Weather Report for 1877. (New Series.) Appendices and Plates. 27*s.*; Part I., 10*s.*; Part II., 5*s.*; Part III., 4*s.* 6*d.*; Part IV., 6*s.*

53. Meteorological Atlas of the British Isles. 5*s.* 6*d.*

54. Hourly Readings, 1882. Parts I. and II., 20*s.* each. Part III., 22*s.* 6*d.* Part IV., 26*s.*

55. Quarterly Weather Report for 1878. (New Series.) Appendices and Plates. 28*s.*; Parts I., II., III., and IV., 6*s.* each.

56. Sunshine Records of the United Kingdom for 1881. 4*s.*

57. Meteorological Observations at Stations of the Second Order for the year 1880. 34*s.* 6*d.*

58. Report for 1882–3. Presented to Parliament. 10½*d.*

59. Sea Temperature Charts for the Atlantic, Pacific, and Indian Oceans. 21*s.*

60. Principles of Weather Forecasting. By the Hon. Ralph Abercromby, F.R.Met.Soc. (Second edition, revised), 2*s.*

61. The Barometer Manual for the Use of Seamen. 1*s.* 3*d.*

62. Monthly Weather Report, 1884. Jan., Feb., March, May—Nov., 1*s.* 6*d.* each. April (with 2 Appendices), 2*s.* 6*d.* Dec., 1*s.* 9*d.*

63. Hourly Readings, 1883. Parts I., II., and III., 21*s.* each. Part IV., 30*s.*

64. Report for 1883-4. Presented to Parliament. 1*s.* 2*d.*

65. Monthly Weather Reports for 1885. Jan. to Dec. 1*s.* 6*d.* each.

66. Meteorological Observations at Stations of the Second Order for the year 1881. 35*s.*

67. Report for 1884–5. Presented to Parliament. 4*s.* 4*d.*

68. Monthly Weather Reports for 1886. Jan. to Dec., 1*s.* 6*d.* each.

69. Meteorological Observations at Stations of the Second Order for the year 1882. 35*s.*

70. Hourly Readings, 1884. Part I., 12*s.*; Part II., 10*s.*: Part III., 10*s.* 6*d.*: Part IV., 15*s.*

71. Synchronous Weather Charts of the North Atlantic and the adjacent Continents. Aug. 1, 1882 to Sept. 3, 1883. Parts I., II., III. and IV. (33 sheets each.) 17*s.* each.

72. Report for 1885–86. Presented to Parliament. 8*d.*

73. Meteorological Observations at Stations of the Second Order for the year 1883. 30*s.*

74. Hourly Readings, 1885. Parts I. and II., 11*s.* each. Part III., 10*s.* 6*d.* Part IV., 12*s.*

75. Report for 1886–87. Presented to Parliament. 8*d.*

76. Charts showing the Mean Barometric Pressure over the Atlantic, Indian, and Pacific Oceans. 10*s.* 6*d.*

77. Monthly Weather Reports for 1887. January to April, 1*s.* 6*d.* each. May and June. (In the Press.)

78. Meteorological Observations at Stations of the Second Order for the year 1884, 32*s.*

79. Report for 1887–88. Presented to Parliament. Price 1*s.*

80. Monthly Weather Report for 1888. January. (In the Press.)

81. Hourly Readings. 1886. Part I. (In the Press.)

LIST OF PUBLICATIONS, &c.—*continued.*

NON-OFFICIAL.

No. 1. Report to the Committee on the Connexion between Strong Winds and Barometrical Differences.—By Robert H. Scott, Director of the Office. 6*d.*

*2. Report to the Committee on the Meteorology of the North Atlantic.—By Captain H. Toynbee, Marine Superintendent. 1*s.*

*3. Report to the Committee on the Use of Isobaric Curves.—By Captain H. Toynbee, Marine Superintendent. 1*s.*

4. Routes for Steamers from Aden to the Straits of Sunda and back. Translated from a Paper issued by the Royal Meteorological Institute of the Netherlands. 6*d.*

5. On the Winds, &c. of the North Atlantic along the Tracks of Steamers from the Channel to New York. Translated from a Paper issued by the Deutsche Seewarte, Hamburg. 6*d.*

6. Report of the Proceedings of the Meteorological Conference at Leipzig. 1*s.*

7. Notes on the Form of Cyclones in the Southern Indian Ocean.—By C. Meldrum, M.A., F.R.S. 6*d.* [Out of Print.]

8. Report on Weather Telegraphy and Storm Warnings. Presented to the Meteorological Congress at Vienna. 6*d.*

9. Report of the Permanent Committee of the Vienna Congress for 1874. 1*s.* 6*d.*

10. On the Physical Geography of that part of the Atlantic which lies between 20° N. and 10° S. and extends from 10° to 40° W. A Paper read before the British Association at Bristol, in August 1875.—By Capt. Toynbee, F.R.A.S., F.R.G.S., Marine Superintendent. 1*s.* 6*d.*

11. Report of the Permanent Committee of the Vienna Congress for 1876. 2*s.*

12. Reports to the Permanent Committee of the Vienna Congress on Atmospheric Electricity, Maritime Meteorology, and Weather Telegraphy, 1878. 2*s.*

13. Report of the Permanent Committee of the Vienna Congress for 1878. 6*d.*

14. Report of the International Meteorological Committee Meeting at Berne, 1880. 1*s.*

15. Report of the Second Meeting of the International Meteorological Committee, held at Copenhagen, August 1882. 2*s.* 6*d.*

16. Report of the Third Meeting of the International Meteorological Committee, held at Paris, September 1885. 1*s.*

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LONDON: Printed by EYRE and SPOTTISWOODE,
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REPORT

OF THE

METEOROLOGICAL COMMITTEE

OF THE

ROYAL SOCIETY,

For the Year ending March 31st, 1880.

LONDON:

REPORT

OF THE

METEOROLOGICAL COUNCIL

TO THE

ROYAL SOCIETY,

For the Year ending 31st of March 1869

REPORT

OF THE

METEOROLOGICAL COUNCIL

TO THE

ROYAL SOCIETY,

For the Year ending 31st of March 1889.

Presented to both Houses of Parliament by Command of Her Majesty.

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THE METEOROLOGICAL COUNCIL,

1888–89.

Lieutenant-General RICHARD STRACHEY, R.E., C.S.I., F.R.S., Chairman.

MR. ALEXANDER BUCHAN, M.A., LL.D., F.R.S.E.

Professor GEORGE HOWARD DARWIN, M.A., LL.D., F.R.S.

MR. FRANCIS GALTON, M.A., F.R.S.

MR. EDWARD J. STONE, M.A., F.R.S.

Captain WILLIAM J. L. WHARTON, R.N., F.R.S., Hydrographer of the Admiralty.

REPORT

OF THE

METEOROLOGICAL COUNCIL

TO THE

ROYAL SOCIETY,

For the Year ending March 31, 1889.

Introductory.

THERE has been no change in the Council during the year. The only alteration in the administration of the Office has been that caused by the retirement of Captain Toynbee, as intimated in the last Report. The executive officers now are:—

Mr. R. H. Scott, M.A., F.R.S., Secretary.
Nav.-Lieut. C. W. Baillie, R.N., F.R.A.S., Marine Superintendent.

The attention of the Council having been drawn by the Treasury to the increased cost of printing of the publications issued from the Office, it was resolved that inquiries should be made of the Stationery Office to admit of the reconsideration by the Council of the present system, with a view to effecting every practicable reduction.

On the proposal of Professor Wild (St. Petersburg), that a meeting of the International Meteorological Committee should take place at Zürich, Mr. R. H. Scott, the Secretary of the Council, was authorised to attend, and the meeting took place in September 1888. The report of the proceedings at this meeting has been separately published. The principal conclusion arrived at (apart from those of a purely technical nature, to which reference is not necessary) was that there were insuperable difficulties in the way of continuing to convene International Congresses, of the character of those held at Vienna and Rome, and that henceforth the requirements of the case would be sufficiently met by assembling from time to time, by mutual agreement, representatives of the Meteorological Services in various countries, who were disposed to meet for the discussion of matters of interest. The Meteorological Council assented to this conclusion.

The present Report is arranged under three headings:—

I. Ocean Meteorology.
II. Weather Telegraphy.
III. Land Meteorology of the British Isles.

PART I.

Ocean Meteorology.

Collection of information.

Collection of Information.—The practice followed by the Office with reference to observers at sea, as described in former Reports, remains unchanged.

Recognition of "excellent" observers.

Appendix 1. (p. 31) contains a list of all the observers who have contributed logs during the past year, classed as "excellent." Several of them have regularly co-operated with the Office for many years. The names which appear in the list for the first time are as follow:—

Captain's Name.	Ship.
Belding, R.	"Atlantic."
Briscoe, R. F.	S.S. "Kaisar-i-Hind."
Campbell, Robert	S.S. "Elton."
Chaddock, E. T.	"Elvira."
Clark, Alexander	S.S. "Cardiganshire."
Clarke, A. C., Commr. R.N.	H.M.S. "Espiègle."
Couper, William	"Clackmannanshire."
Craig, E. A.	S.S. "Claymore."
Field, A. M., Lieut. and Commr. R.N.	H.M.S. "Dart."
Hart-Dyke, A.	S.S. "La Plata."
Haselwood, R. W. B.	S.S. "Kaisar-i-Hind" and S.S. "Rohilla."
Hicks, G. M.	S.S. "Nile."
James, W. D., Esq.	"Lancashire Witch." R.Y.S.
Jennings, R. C.	S.S. "Colina."
Kiddle, Lieut. E. W., R.N.	H.M.S. "Egeria."
Long, Mr. J. C.	S.S. "Kaisar-i-Hind."
Munn, L. A.	S.S. "Durban."
Powles, F. W.	S.S. "Essequibo."
Rigaud, H. C.	S.S. "Derwent."
Ritchie, Alexr.	"Four Winds."
Rowsell, P.	S.S. "Tagus."
Spooner, I. D.	S.S. "Tamar."
Swinton, W. W.	"Banffshire."

Proportion of "excellent" to total number of logs received.

The total number of logs received in the year ending March 31, 1889, is 189, of which 152, or 80 per cent., have been classed as "excellent," being a larger per-centage of "excellent" logs than has been reported for some years.

The average number of logs received annually during the five years, 1883–87, was 184, of which the per-centage of "excellent" logs was 73.

The Council take this opportunity of expressing their best thanks to the observers who have assisted them during the past year.

Appendix II. (p. 34) gives a list of all meteorological logs and of meteorological reports from stations abroad, received at the Office during the year.

Voyages from which observations are obtained.

The following summary of the voyages of the ships observing for the Office shows the districts from which observations were received during the year:—

To Baffin's Bay or Greenland - - - -	6
„ North America, East Coast - - -	16
„ „ „ West „ - - - -	5
Off East Coast of North America - - -	3
To South America, East Coast - - - -	15
„ „ „ West „ - - - -	10
„ Australia and New Zealand, viâ Cape of Good Hope	35
„ „ „ „ Suez - -	2
At Australian stations - - - - -	8
To India, viâ Suez - - - - -	16
„ India, viâ Cape of Good Hope - - -	25
„ China Seas, viâ Suez - - - -	10
„ Cape of Good Hope - - - -	7
„ West Indies - - - - -	18
Between British Ports - - - - -	6
To Mediterranean Ports - - - -	7

North Atlantic Weather Charts.

North Atlantic Weather Charts.—These charts, which refer to the 13 months ending September 3, 1883, have now been issued. They may justly be regarded as supplying the most complete representation of Atlantic weather which has yet appeared, the material collected for their preparation being unusually copious and trustworthy. Their value is enhanced owing to the observations made during the same period by the International Polar Expeditions, as well as those made on land and at sea in co-operation with the work of those expeditions. The very complicated series of phenomena recorded in these charts is undergoing a preliminary investigation by the Secretary. See Note A., p. 22.

Meteorology of the Red Sea.

Red Sea Charts.—The discussion of the Meteorology of the Red Sea, mentioned in former Reports, is still in progress, and the work is now well advanced. The observations used in addition to those contained in the Office logs are those from the logs of H.M. ships obtained from the Admiralty; these data are supplemented, when necessary, by information obtained from the Royal Meteorological Institute of the Netherlands, and the Peninsular and Oriental Steamship Company.

Barometrical pressure charts.

The Charts of Barometrical Pressure for the Atlantic, Pacific, and Indian Oceans for the months of February, May, August, and November have been issued. A chart showing the mean barometrical pressure for the year and another to indicate the extent of range of irregular fluctuations, have also been prepared for the same oceans, and will shortly be published. These charts will, it is hoped, be of great value to mariners.

Current charts.

Current Charts for the Atlantic, Pacific, and Indian Oceans.—Considerable progress has been made during the year in the construction of these charts, and it is hoped that by the end of the year the whole of the data relating to currents contained in the Office logs will have been entered on the charts. A large amount of valuable information is also being obtained from the logs

Current charts.

of Her Majesty's ships. Among the interesting points brought out incidentally during the investigation, shown by the small amount of information obtained from the anticyclonic regions of the great oceans, is that these regions, characterised by calms and light variable winds, are practically avoided by navigators.

Cape Guardafui.

Cape Guardafui Charts.—The charts referred to last year as originally designed to represent the winds, currents, temperature of the sea, &c., off Cape Guardafui during the South-west Monsoon are now being prepared for each month of the year. They will probably be completed in the course of the autumn. Authentic and trustworthy records of the rapid changes of temperature over comparatively short distances, in this part of the ocean, and of the varying winds during the course of the year, will be of considerable value to sailors navigating these seas, and are likely to throw light on important physical questions relating to the circulation of the ocean waters.

Charts of the Aden cyclone, 1885.

The Aden Cyclone of June 1885.—As stated in last year's Report, Synchronous Daily Charts of the North Indian Ocean have been prepared to illustrate the progress of this storm, which was of a somewhat exceptional nature, and therefore appeared to call for special treatment. These charts are in the press and in an advanced stage.

Indian Ocean cyclone tracks.

Cyclone Tracks in the Southern Indian Ocean.—These charts are now nearly complete, and only await the receipt of additional data from Dr. Meldrum. As intimated in the Report for 1887, the information they will convey, as to the frequency and tracks of cyclones in this area for a period of nearly 20 years, will be of great importance to seamen.

Foreign stations.

Tobago.

Supply of Instruments to Foreign Stations.—Meteorological instruments have been supplied on loan to the Island of Tobago, where Dr. J. S. Tulloch, Colonial Surgeon, has undertaken to keep a record.

Aden and Perim.

Observations at Aden and Perim.—A communication having been made to the Director of the Indian Meteorological Department as to the importance of obtaining meteorological registers from these stations, he replied that an observatory had been established at Aden, and that endeavours would be made to obtain observations from Perim.

Sanchez.

Observations at St. Domingo.—The late Dr. W. Reid having presented to the Office three volumes of Meteorological Observations extending over the years 1886, 1887, and 1888, made at Sanchez, Samanà Bay, at the east end of St. Domingo, the Council resolved to print the results in a condensed form, the information being regarded as of considerable scientific value.

Future work.

The future Marine Work of the Office.—As already intimated, a discussion of the meteorological information available for the region from the Cape of Good Hope to New Zealand will be proceeded with by the Marine Department during the year as opportunity offers, on the method adopted in dealing with parts of the Atlantic.

Contributions to our Knowledge of the Meteorology of the Arctic Regions.—Part V. of this work has now been published, and completes the discussion of the data furnished by the Franklin Search Expeditions for the months in which the ships were in winter quarters. Arctic meteorology.

Supply and Stock of Instruments.—In Appendix III. (p. 41) is given a list of the meteorological instruments supplied by the Office to ships in the Royal Navy during the year, with a statement of the stock and distribution of the instruments standing on the books, to the account of the Admiralty, on the 31st March 1889. Instruments belonging to the Office.

Appendix IV. (p. 42) gives similar information with regard to the disposal of the other instruments belonging to the Office, remaining in store, or which have been supplied to the Mercantile Marine, observatories, telegraph offices, &c.

PART II.

Weather Telegraphy.

There have been no changes in the service during the year, and there are no serious interruptions to chronicle. Administrative.

The following changes in the reporting staff may be noted:—at Malin Head, Mr. Owen O'Doherty has succeeded Mr. J. O'D. Farren; at Spurn Head, Mr. J. B. Smith has been replaced by Mr. Watson; and at Aberdeen, Mr. Boswell has succeeded Mr. J. M'Cormack, whose death was mentioned in the last Report.

A list of the telegraphic reporters is given in Appendix V. (p. 43). A Map showing the stations was inserted in last year's Report.

The work in this branch of the Office continues to increase. The Daily and Weekly Weather Reports, in particular, have been extended and improved.

Inspection of the Telegraphic Reporting Stations.—The telegraphic reporting stations have been inspected during the year, in Scotland by Mr. Buchan, and in Ireland and Wales by Mr. Scott. The Inspector for England, the Rev. W. Clement Ley, was unfortunately prevented by serious illness from discharging his duties during the year, and the English inspections were therefore incomplete. Some of the stations, however, were inspected by Captain Toynbee and by members of the Office staff. The reports submitted by the Inspectors to the Council, which are printed in Appendix VI. (p. 44), show that the efficiency of the service continues to be satisfactorily maintained. Inspection of the Stations.

Discussion and Publication of the Information received.—The practice of the Office in collecting, discussing, and disseminating the meteorological information received by telegraph is described in Appendix VII. (p. 57). The Daily Weather Report is distributed free of cost as follows:—To newspapers, three copies; to seaports, for public exhibition, 60 copies; to Government offices and public institutions, 76 copies; to correspondents of the Office, 58 copies; and to foreign meteorological establishments, 35 copies. Nearly 200 copies are issued regularly to subscribers. Discussion of the reports.

Forecasts.

Weather Forecasts.—Forecasts continue to be prepared three times a day, at 11 a.m., at 3.30 p.m., and 8.30 p.m. The Forecasts prepared at 11 a.m., on the information derived from the 8 a.m. reports, refer to the probable weather between noon on the day of issue and noon on the following day. They are publicly exhibited in several places in London,* and supplied for the afternoon editions of the newspapers. The 3.30 p.m. Forecasts are employed for storm warnings only, excepting in the hay harvest season, when they are issued as subsequently explained. The forecasts prepared at 8.30 p.m. are intended primarily for the newspapers, but any forecast is available for the information of anyone who applies for it at the Office.

Inquiries at the Office.

The inquiries received through the Post Office for special forecasts during the year amounted to 63, and the personal applications to 52. The rules of the Office relating to such inquiries are stated in Appendix VII. (p. 64).

Testing of the Forecasts.

The results of a comparison of the Forecasts issued at 8 p.m. during the year with the weather actually experienced are given in Appendix X. (p. 68). The following summary shows the successes and failures over the whole United Kingdom estimated as explained in that Appendix:—

SUMMARY OF RESULTS of 8.30 p.m. FORECASTS, 1888–9.

Districts.	Per-centages.				Total per-centage of Success.
	Complete Success.	Partial* Success.	Partial* Failure.	Total Failure.	
SCOTLAND, N. - -	54	31	10	5	85
„ E. - -	54	30	11	5	84
ENGLAND, N.E. - -	52	33	8	7	85
„ E. - -	51	34	9	6	85
MIDLAND COUNTIES -	49	34	11	6	83
ENGLAND, S. - -	55	31	10	4	86
SCOTLAND, W. - -	41	36	15	8	77
ENGLAND, N.W. -	48	33	12	7	81
„ S.W. -	53	33	9	5	86
IRELAND, N. - -	48	33	12	7	81
„ S. - -	47	31	14	8	78
Average - -	50	33	11	6	83

* Note "partial" implies "more than half."

* Viz., in the City, at the Mansion House, Lloyd's Rooms, Messrs. R. & J. Beck's, Cornhill, and Messrs. de la Rue & Co.'s, Bunhill Row; in the West End, in the Libraries of the House of Lords and House of Commons; at Messrs. Elliot's, St. Martin's Lane; Messrs. Stanford's, Charing Cross; Messrs. Negretti & Zambra's, Regent Street; and Messrs. Pastorelli's, New Bond Street.

Testing of Forecasts.

The following table shows for each year from 1881 to 1889 the per-centages of complete and partial success of the Forecasts issued at 8.30 p.m. for the whole year. Without questioning that improvements may be hoped for as a result of further research, it is doubtful how far greater success is likely to be attained so long as the means of obtaining information of atmospheric changes to the westward continues to be limited, as it is at present, by the barrier caused by the Atlantic.

PER-CENTAGES of RESULTS of FORECASTS for the whole of the BRITISH ISLES.

Year.	Complete Success.	Partial, *i.e.*, more than Half Success.	Total Success.
1881 - -	34	44	78
1882 - -	44	35	79
1883 - -	48	33	81
1884 - -	51	31	82
1885 - -	51	32	83
1886 - -	49	32	81
1887 - -	53	31	84
1888 - -	50	33	83
Average - -	47	34	81

Checking Forecasts.—Special attention has been directed to the system under which estimates of success in forecasting, such as those furnished in the foregoing tables, are obtained by a comparison of the actual weather with the predictions made in the Forecasts; so that a constant watch may be kept on the preparation of the Forecasts by the assistants specially charged with this branch of the work, and their attention may be directed to any erroneous judgments they may have formed, and the nature of such errors as far as possible indicated to them.

Hay Harvest Forecasts.

Hay Harvest Forecasts.—The Council renewed in 1888 the offer made in previous years to the Royal Agricultural Society, the Royal Dublin Society, and the Highland and Agricultural Society to send Daily Forecasts *gratis* during the haymaking season to a number of observers selected by those Societies, on two conditions, viz., that the information should be made known as widely as possible, and a record of the weather actually experienced sent

Hay Harvest Forecasts.

weekly to the Office. The Societies accepted the proposal, and the Forecasts were issued as shown in the following table :—

LIST of those who received HAY HARVEST FORECASTS in 1888.

Districts.	To whom sent.	Address.
0. SCOTLAND, N.	Rev. Dr. Joass	Golspie.
	Major Smith	Munlochy, Inverness.
1. SCOTLAND, E.	J. Whitton	Glamis, by Forfar.
	W. W. Kerr	Ferrygate, North Berwick.
	G. Murdock	Rothiemay, Huntly.
	C. L. W. Forbes	Aberfeldy.
2. ENGLAND, N.E.	J. Wilson	Chillingham Barns, Chatton, Northumberland.
	J. Turner	The Grange, Ulceby.
3. ENGLAND, E.	W. Birkbeck	High House, Thorpe, Norwich.
	Sir J. B. Lawes, Bt., and J. H. Gilbert, Ph.D.	Rothamsted, Harpenden.
4. MIDLAND COUNTIES	Royal Agricultural College.	Cirencester.
	E. E. Harcourt-Vernon	Grove Hall, East Retford.
5. ENGLAND, S.	C. Whitehead	Barming House, Maidstone.
	E. P. Squarey	The Moot, Downton, Wilts.
	G. M. Allender	Stammerham, Horsham.
6. SCOTLAND, W.	W. Calder	Castle Hill, Dalreoch, Dumbarton.
	M. J. Stewart, M.P.	Ardwell, Stranraer.
	J. S. R. Ballingal	Eallabus House, Islay.
7. ENGLAND, N.W.	G. W. Wray	Leyburn, Yorkshire.
	The Earl of Derby, K.G.	Knowsley Hall, Prescot.
8. ENGLAND, S.W.	Colonel J. B. Turbervill	Ewenny Priory, Bridgend, Glamorganshire.
	The Earl of Ducie	Spring Park, Gloucestershire.
	T. Dyke	Long Ashton, Clifton, Bristol.
	R. Neville Grenville	Butleigh Court, Glastonbury.
9. IRELAND, N.	Rev. Canon Nesbitt	Hollymount Rectory, Co. Mayo.
	E. F. Farrell	Moynalty, Co. Meath.
10. IRELAND, S.	D. A. M'Cready	Larchvale, Moneygall, King's Co.
	D. A. Milward	Lavistown, Kilkenny.
	W. Talbot Crosbie, D.L.	Ardfert Abbey, Tralee, Co. Kerry.

The issue of the forecasts commenced June 11th with those for England S. and E., and later for the other districts.

They were continued for nearly six weeks, and only ended for Scotland on August 25th.

In more than one case the forecasts were continued, until the completion of the corn harvest, at the cost of those who received the telegrams.

The general result of the issue of these forecasts, shown by the subjoined table, has been prepared solely from the reports of the above-mentioned gentlemen:— Hay Harvest Forecasts.

SUMMARY of RESULTS.—HAY HARVEST FORECASTS, 1888.

Districts.	Names of Stations.	Percentages.				
		Complete Success.	Partial Success.	Partial Failure.	Total Failure.	Total percentage of Success.
SCOTLAND, N. -	Golspie and Munlochy - - -	48	34	17	1	82
„ E. -	North Berwick, Glamis, Aberfeldy, and Rothiemay.	43	41	11	5	84
ENGLAND, N.E. -	Chatton and Ulceby - - -	50	27	17	6	77
„ E. -	Thorpe and Rothamsted - -	48	39	10	3	87
MIDLAND COUNTIES	Cirencester and East Retford -	53	32	9	6	85
ENGLAND, S. - -	Horsham, Maidstone, and Downton -	52	40	6	2	92
SCOTLAND, W. -	Dumbarton, Islay, and Stranraer -	45	41	8	6	86
ENGLAND, N.W. -	Leyburn and Prescot - - -	57	24	11	8	81
„ S.W. -	Bridgend (Glamorgan), Clifton, Glastonbury and Spring Park (Gloucestershire).	46	36	13	5	82
IRELAND, N. - -	Moynalty and Hollymount - -	48	38	14	5	81
„ S. - -	Moneygall, Kilkenny, Ardfert Abbey -	53	31	10	6	84
	Mean for all districts, 1888 - -	49	35	11	5	84
	„ „ 1887 - -	56	32	8	4	88

These figures show that the result of last year's checking fell four per cent. below that of 1888, and this may be attributable to the very broken character of the weather during the summer of last year, which added considerably to the difficulties of forecasting and the exceptional quietness of the weather in 1887.

The highest percentage of success was in England S., and the lowest in England N.E.

In addition to the gentlemen who received the forecasts gratuitously, nine large landowners residing in different parts of the country applied to be furnished with the forecasts at their own expense.

Additional testimony as to the general correctness of the forecasts during the summer of 1888, and their value to, and appreciation by, the agricultural community, was transmitted to the Office by the Rev. Dr. Joass (Sutherlandshire), Mr. Turner (Lincolnshire), Mr. Wray (Yorkshire), Mr. Fergusson (Suffolk), Mr. Neville Grenville (Wiltshire), and Mr. Dawson Milward (co. Kilkenny).

A correspondence took place between the Meteorological Office and the Agricultural Department of the Privy Council on the subject of the possible wider diffusion of the information supplied by the Hay Harvest Forecasts. The Meteorological Council expressed their readiness to co-operate in any way in their power in an object the utility of which had been sufficiently established by its general recognition by the well-qualified persons to whom the forecasts had been supplied in past years. At the

Hay Harvest Forecasts.

same time, they intimated that the funds at their disposal were insufficient to admit of any gratuitous issue of forecasts in excess of that now going on. The Agricultural Department having stated that they had no funds at their disposal and that the Treasury had declined to make a grant for the purpose, the matter was dropped. The Council, however, hope that some arrangement may be found possible under which this desirable object may be carried out, the cost of which would be insignificant if spread over the large area that would benefit by it, though the aggregate amount is quite beyond the means of the Meteorological Office.

Storm warnings.

Storm Warnings for the Coasts of the United Kingdom.—In Appendix IX. (p. 66) are given the names of the stations furnished with signals for Storm Warnings, in accordance with Circular 717 of the Board of Trade issued in February 1874.

These stations were, at the end of March 1889, 146 in number, situated :—

70 in England, 14 in Wales, 41 in Scotland, 15 in Ireland, 3 in the Isle of Man, and 3 in the Channel Islands.

With a view to adding to the efficiency of these warnings a revision of the districts in which the stations are arranged has been made, and further measures will be taken to improve the record of storms on the coasts by means of which the sufficiency of the warnings will be better checked.

A comparison has been made in the Office between the warnings issued in 1888 and the weather experienced on our coasts, the warnings being tested by the method explained in Appendix VII. (p. 64). The results of this comparison are shown in the following tables :—

RETURN of the Result of the Comparison between the Warnings issued and the Weather experienced in 1888.

Coasts.	Total No. of Orders to hoist and repetitions.	Warnings justified by subsequent Gales. Force 8 and upwards.	Warnings justified by subsequent strong Winds. Forces 6 and 7.	Warnings not justified by subsequent Weather.	Warnings late. Force 9 reached at two Stations before issue.	Warnings partially late. Force 9 reached at one Station before issue.	Warnings in Error owing to telegraphic mistakes.	Storms for which no Warning was issued.
Ireland, South -	57	32	11	13	—	1	—	March 11. Dec. 25.
„ East -	64	28	25	7	—	4	—	
Scotland, East -	70	43	12	12	—	3	—	May 13.* Oct. 12.*
„ West -	55	25	25	4	—	1	—	
England, North-west	56	38	11	7	—	—	—	
„ West -	53	26	21	6	—	—	—	
„ South-west	46	26	12	8	—	—	—	March 11.
„ South -	46	31	10	5	—	—	—	
„ South-east	40	19	15	5	—	1	—	
„ East -	52	30	12	10	—	—	—	
Totals - -	539	298	154	77	—	10	—	
Per-centages -	—	55·3	28·6	14·3	—	1·8	—	

* These gales were not felt south of Aberdeen.

NOTES as to GALES in 1888 for which WARNINGS were not issued. Storm warnings.

March 11.—*Strong South-westerly to Westerly gale in the S.W. of England, and North-westerly gale in the S. of Ireland.*—At 6 p.m. on March 10th there was no indication of a storm on our coasts, although the distribution of pressure was of a rather complex character. By 10 p.m. a shallow disturbance had been developed off our south-western coasts, and subsequently grew deep with extraordinary rapidity. By 8 a.m., 11th, the centre had reached Pembroke, where the barometer had fallen 0·85 in. (to 28·87 ins.), and a gale had set in on all our south-western coasts. At 6 p.m. the centre was over Lincolnshire.

May 13–14.—*Strong North-westerly gale in extreme N.E. of Scotland.*—At 8 a.m., 13th, a depression lay off the W. of Norway, whence it moved steadily to the south-eastward. There is nothing in the information available at present to explain why the wind attained a force so great as it did in this region.

October 12.—*Strong North-westerly gale in extreme N.E. of Scotland.*—At 8 a.m., 12th, a well-formed, but not deep, depression lay off the N.W. of Norway and was moving east-south-eastwards. The gale in question seems to have been the result of some small secondary system not shown by our 8 a.m. reports, and of the existence of which it was impossible to know anything, owing to the entire absence of stations to the north-westward of the Shetland Islands.

December 25.—*Strong Southerly gale in Ireland, S.*—This gale was brought about by the rapid advance to our western coasts of a well-formed depression from the south-westward. At 6 p.m. on December 24th there was nothing to indicate the approach of the disturbance. At Valencia the wind was light from W.N.W., and the barometer stood at 29·60.

The following table contains a comparative statement of the storm warnings and their results in 1888, and in the ten preceding years. It will be seen that the total percentage of warnings justified is 83·9, being slightly higher than that for the preceding year:— Comparison of results for 1888 with previous years.

Years.	Total No. of Warnings issued.	Warnings justified by subsequent Gales.	Warnings justified by subsequent strong Winds.	Total Warnings justified.	Warnings not justified by subsequent Weather.
1878	485	56·7	20·8	77·5	17·9
1879	509	50·5	25·1	75·6	20·6
1880	390	58·2	24·6	82·8	13·3
1881	454	58·6	23·3	81·9	14·8
1882	503	61·4	21·1	82·5	14·9
1883	610	56·2	21·6	77·8	20·8
1884	461	66·4	20·0	86·4	12·1
1885	591	55·3	24·0	79·3	19·5
1886	542	55·3	26·9	82·2	15·9
1887	472	55·5	26·1	81·6	16·4
1888	539	55·3	28·6	83·9	14·3

The Council desires to record its obligation to "Lloyds" for an offer to co-operate in the supply of information likely to be useful to the Meteorological Office from their Signal stations, an offer of which the Council were very ready to avail themselves.

Fishery barometers.

Fishery Barometers.—To add to the means of obtaining warnings of stormy weather by the sea-going population, barometers were many years ago supplied by the Board of Trade on loan to fishing villages and other places on the coast, to be set up for public information. The whole number of stations supplied by the Office with these instruments is 169, of these 59 are in England, 5 in Wales, 48 in Ireland, 53 in Scotland, 3 in the Isle of Man, and 1 in Jersey. The list is given in Appendix VIII., p. 65.

The inspection of the fishery barometers referred to as contemplated in last Report has been partially carried out during the year. The whole of the Scotch stations have been visited by Mr. H. N. Dickson, F.R.S.E., who was entrusted with the duty by the Scottish Meteorological Society, which body has consented, at the request of the Council, to undertake the general supervision of the public barometers maintained by the Office in Scotland. Some stations in the north of Ireland were visited by Captain Toynbee, and some on the east coast of England by the Hon. R. Abercromby. The result of the inspection is, on the whole, satisfactory; in only a few instances was it thought necessary to recommend any change either in the situation or care of the instruments.

The inspectors have in many cases found the fishing population desirous of obtaining information as to the principles on which the scientific forecasting of weather is carried out, and instruction on this subject has been given as far as was possible.

Atlantic telegrams.

Atlantic Telegrams.—As stated in last year's Report, the Council then discontinued their participation in the payment for these telegrams, but, through the kindness of Professor Mascart, they have received copies of them by post from Paris. These were for a long period regularly examined, and the information entered on charts, with a view to their value as aids to weather forecasting being further tested. The result has been the conclusion that, in the present state of our knowledge, such telegrams are of no practical utility for the object in question, and the Council, though with some hesitation, determined that the time required for their study could no longer be devoted to them, with due regard to the many other demands on the special staff employed on the difficult and responsible duty of preparing the forecasts.

Publications.

Weather Reports.—The Daily Weather Report has appeared regularly; for details, see Appendix VII., p. 59.

The Weekly Weather Report has been further modified and improved, with a view of bringing it more completely up to the standard of information that the present requirements of students of Meteorology demand, in relation to the various practical objects and occupations in which the conditions of the weather are important or influential. The small charts have been enlarged so that the area represented now covers nearly the whole of Europe.

Publications.

The Quarterly Summary, issued as Appendix I. to the Weekly Weather Report, gives summaries for each quarter, and for the whole year, of the Rainfall and Temperature for each district, for the 23 years 1866–1888, and also the Monthly and Progressive values of Accumulated Heat, Rainfall, and Bright Sunshine for all the districts in each month of 1888. Appendix II. to the same Report gives the Weekly and Progressive values for the same elements during the year 1888 (in continuation of Appendix II. for the year 1887), and Appendix III. gives the Mean Weekly values for the following number of years :—

Accumulated Heat and Rainfall, 11 years, 1878 to 1888.
Bright Sunshine - - 8 „ 1881 „ 1888.

Appendix IV. gives for each district, for the 11 years 1878 to 1888, the mean temperature for each week in the year.

The Monthly Weather Report, which has been discontinued as a separate publication, will appear in future as a supplement to the Weekly Weather Report.

Simultaneous observations.

Simultaneous Observations.—The Office has continued its co-operation in the system of International simultaneous observations, taken at Greenwich mean noon, as explained in former Reports, which was organised in 1874, at the request of the Chief Signal Officer of the United States.

The number of these observations which have been received during the year from the Royal Navy has been 6,070, and from the Mercantile Marine, 7,380.

PART III.

Land Meteorology of the British Isles.

Observatories and Stations.—The observations of the climate of the British Isles, which are received by the Office from certain stations, may be arranged in five classes, according to the completeness or fulness with which they are made.

Self-recording observatories.

1. The Observatories furnished with self-registering instruments by which all the principal meteorological phenomena are recorded continuously. These alone afford the materials necessary for the study of the periodic variations of the meteorological elements.

Anemographic stations.

2. Anemographic stations furnished with instruments registering the wind only. The records from these stations relate rather to weather as distinguished from climate, and are especially useful in connexion with storms, and as affording, amongst other uses, evidence available in courts of law with respect to collisions at sea, and damage done by wind.

Stations of Second Order.

3. Stations of the Second Order furnishing climatological information from eye observations taken twice a day. The observers at these stations are all volunteers.

Telegraphic Reporting Stations.

4. The Telegraphic Reporting Stations, at which eye observations are taken, supplemented in some cases by self-recording aneroids, &c., supply the material upon which the daily weather

Stations. reports and forecasts are based. The hours of observation at these stations are determined by the requirements of the telegraphic system, as explained in Part II., but the data which they furnish are also utilized to afford climatological information for parts of the country where Stations of the Second Order do not exist.

Extra stations. 5. Extra stations furnishing returns with less completeness and detail than those of Class 3.

Sunshine stations. A continuous record of the amount of bright sunshine is received from 38 stations in the British Isles, of which some are first or second order stations, whilst from others the sunshine record is alone received, and the weekly totals are received from three other stations. See p. 69.

A fuller account of these several stations and of the methods employed by the Office in dealing with their records will be found in Appendix XII., p. 70.

Documents received. Appendix XIII., p. 75, contains a list of all documents relating to the land meteorology of the British Isles received at the Office during the year.

Regulations for Observatories. *Regulations of Work at principal Observatories.*—The regulations for the management of the self-recording instruments have been carefully revised. The experience of nearly 20 years has shown that in all essentials the instruments are thoroughly satisfactory, and that very small alteration was required in the instructions originally issued for their use.

Inspection of Stations. *Inspection of the Stations.*—The self-recording observatories and the anemographic stations (Classes 1 and 2), as well as the Telegraphic Reporting Stations (Class 4), are regularly visited each year by the Inspectors of the Office. The extra stations (Class 5) are inspected as opportunity offers. Of the Stations of the Second Order (Class 3), some belong to the Royal Meteorological Society; these are visited by an Inspector appointed by that Society, an allowance being made by the Office toward the cost of the inspection, in accordance with the recommendation of the Treasury Committee (1877); and some belong to the Scottish Meteorological Society. The remaining Stations of the Second Order are visited at least once in every two years by the Inspectors of the Office. The Superintendent of the Kew Observatory, Mr. G. M. Whipple, and his chief assistant, Mr. J. W. Baker, are specially employed to inspect and report on the self-registering apparatus, and on the photographic processes at the observatories. Extracts from the Reports of the Inspectors are given in Appendix VI., p. 44.

Reports supplied to Registrar General for Ireland. *Information supplied to the General Register Office, Dublin.*—Reports from eleven of the Irish stations of the Office have been regularly supplied to the Registrar General for Ireland, for his Weekly and Quarterly Returns.

Publications. *Quarterly Weather Report.*—Parts III. and IV., completing the volume for 1879 of the old series, have been issued. This form of Report will end with the publication of the volume for 1880, of which Part I. is in the press.

Publications.

The publication of the *Hourly Readings* obtained from the records of the self-registering instruments at the four principal observatories for 1886 is completed.

It has been resolved to compute the mean hourly values of the observed temperature of the air and barometrical pressure, for each month, and for all the observatories, for the year 1883; the question of extending this computation to other years was postponed for future consideration.

Mr. Bayard's tables.

Mr. F. C. Bayard having computed the mean monthly hourly values of the barometric pressure for the seven self-recording observatories, for the years 1877 to 1880, to which he has been able to add records from Greenwich and Bidston, the Council considered the results sufficiently valuable to print them, together with those obtained by Mr. H. S. Eaton for 1876.

Observations at Stations of the Second Order.—The volumes for 1884 and 1885 have appeared.

Observations on Ben Nevis.

Observations on Ben Nevis.—The arrangements with the Directors of the Observatory established on the summit of Ben Nevis, at a height of 4,406 feet above the sea, detailed in the Report for 1885, have been continued during the year. The Council have continued the annual grant of 100*l.* towards the expenses of the Observatory, and have received MS. copies of all the meteorological observations taken.

Observations at Fort William.

The Directors of this Observatory having completed arrangements under which they would be enabled to erect at Fort William, at the base of the mountain, a supplementary observatory in connexion with that on the summit, the Council have undertaken to supply at their own charge an outfit of an observatory of the first class, to be equipped with self-recording instruments, a set of which, formerly used at Armagh, is available. The Council have further agreed to grant in aid of the maintenance of the Fort William Observatory a sum of 250*l.* yearly for five years, on the terms, as to the supply of copies of observations to the Meteorological Office, and the like, on which a similar grant is made to the Observatory at Falmouth.

Cloud photography.

Cloud Photography and Measurement.—This subject has continued to receive attention. Many photographs have been taken at Kew, but unforeseen difficulties have arisen in obtaining satisfactory results from them, which, however, it is hoped, may be overcome by improving the instrumental appliances and the method of computation.

Bridled anemometer

The Bridled Anemometer.—The Council having learned that Mr. W. H. Dines, B.A., was engaged in making experiments with anemometers with the aid of a whirling apparatus, requested him to undertake an investigation with the view of determining a scale for interpreting the indications of the bridled anemometer that has been in operation for several years at Holyhead. This Mr. Dines has consented to do, and the subject continues under his observation. The object which this form of anemometer is

Bridled anemometer.

designed to accomplish is the measurement of the varying force of the wind, and particularly of the strongest gusts; a question on which great doubt exists, and the solution of which involves considerable difficulties, while it is of no little practical importance in connexion with the stability of engineering works.

Squalls.

Record of Squalls.—The ordinary self-registering anemometer supplies a satisfactory record of the aggregate movement and velocity of the wind, but fails to indicate sufficiently those momentary or sudden increases of force which constitute heavy gusts and accompany violent squalls, and the occurrence of which is at times the cause of such great destruction. The trace made by this instrument at high velocities can hardly be trusted to give reliable results for a shorter time than 15 minutes, and inquiry is being made as to the frequency of occasions during which a velocity of 10 miles in that time, or 40 miles in an hour, has been recorded. (Note B., p. 27.)

Electrical anemometer.

Electrical Anemometer.—The Council regret to have to record that after very prolonged trial, and repeated attempts to remedy defects, the use of this apparatus has had to be abandoned, for the present at least. The instrument will be removed from Valencia to Kew, where a close examination of its working will be instituted, in the hope that some means may be found for rendering its indications trustworthy, which has not hitherto been accomplished.

The Harmonic analyser.

The Harmonic Analyser.—This instrument continues to be employed for the determination of the harmonic coefficients of the formulæ expressing the diurnal variation of temperature and of barometric pressure. The analysis of the curves obtained from the barographs at the seven observatories of the Office has been completed for the ten years 1871–80 and the curves for 1881 have been dealt with for four of the seven stations.

The harmonic coefficients for the mean diurnal range of temperature were published in 1886, and since then a considerable amount of time has been expended in endeavouring to trace by their aid the sequence of causes which combine to modify the mean diurnal curve of temperature at different seasons of the year and in different parts of the kingdom. To assist in this investigation, the coefficients for periods of five days for the same interval, 1871–1882, are now being calculated.

Records from stations of the Royal Engineer and Army Medical Departments.

Observations from Military Stations.—The summaries of these observations, made under the direction of the Royal Engineer and Army Medical Departments, between 1852 and 1886, have been completed, and the volume is now in the press.

Library.

Library.

The library contains standard works on Meteorology and the allied Sciences, and is, besides, particularly rich in Transactions, Proceedings, Reports, and other Publications which give in a more

Library.

or less detailed form a very large mass of Meteorological observational data from all parts of the world, and extending over many years. It consists at present of over 11,000 volumes and pamphlets, exclusive of charts and MS. records of observations. The books and other documents are accessible to scientific men for reference at the Office.

Appendix XIV., p. 79, contains a list of the additions to the library during the year, which have been catalogued upon cards, and are entered in the reference catalogues under (1) Authors, and (2) Subjects.

Expenditure.

Financial.

Appendix XV., p. 99, shows the receipts and payments during the year ending 31st March 1889. The amount voted by Parliament was 15,300*l.*, as in the previous year.

The following abstract of expenditure shows the amount properly chargeable to the year in question, and its distribution under the various heads, together with the increase or decrease in 1888–89, as compared with the previous year :—

Net Expenditure.	1887-88.	1888-89.	Increase.	Decrease.
General Administration.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Payment of Council -	1,000 0 0	1,000 0 0	—	—
Secretary - -	800 0 0	800 0 0	—	—
Office - - -	806 15 6	798 8 0	—	8 7 6
Rent, fuel, and lighting -	738 17 10	709 17 11	—	28 19 11
Alterations to premises, attendance, and contingencies - -	437 5 11	436 4 0	—	1 1 11
Expenses incidental to International Meteorological Congress -	—	22 2 3	22 2 3	—
Pensions - -	42 16 4	138 16 4	96 0 0	—
Special Researches -.	734 11 10	570 5 0	—	164 6 10
Land Meteorology -	3,141 10 10	3,353 7 1	211 16 3	—
Weather Information -	3,929 15 5	3,845 10 4	—	84 5 1
Inspections - -	524 10 4	702 5 1	177 14 9	—
Ocean Meteorology -	2,517 4 6	2,795 3 3	277 18 9	—
Total - - £	14,673 8 6	15,171 19 3	785 12 0	287 1 3

(Signed) R. Strachey, Chairman.

NOTE A.

NOTES of some RESULTS of an EXAMINATION of the ATLANTIC CHARTS published by the OFFICE; by ROBERT H. SCOTT, F.R.S., Secretary.

IN the last Report of the Council, that for the year ending March 31, 1888, a short notice was included, on the subject of the severe gales which had visited the British Isles between August 1882 and August 1883 inclusive. These storms, as represented on the charts, were discussed with the object of ascertaining to what extent intelligence of their approach to our coasts might possibly have been obtained from telegrams from the other side of the Atlantic. The result of the inquiry was not satisfactory, as will be seen from the Note.

During the past year the study of these charts has been continued, as opportunity offered, and a few facts of some interest have been elicited, which I venture to submit to the Council

It has been already explained that all the clearly marked barometrical depressions or cyclonic systems have been laid down on their proper positions on 13 charts, one for each month, and lines were drawn connecting these positions, as seemed justifiable. Storm tracks were thus formed.

The next step was to tabulate the whole of these tracks, according to longitude, in columns of 10 degrees each. Speaking very generally, these disturbances travel over 10 degrees of longitude in 24 hours. To each day's entry are appended the latitude of the position, the lowest barometer reading recorded, and the principal strong winds reported. These data enable any one consulting the tables to gain a general idea of the history of the disturbance, as they show whether it is increasing in intensity or the reverse, as indicated by the fall or rise of the barometer at its centre, and whether the wind is stronger or weaker. To these entries are added the distance the disturbance has travelled in the preceding 24 hours.

The amount of material contained in these forms is considerable, but it did not seem advisable to attempt to calculate the average height of the barometer or the average rate of travel, say, at each tenth meridian, inasmuch as the number of depressions in each column was very irregular, and the directions of the tracks were not by any means parallel to each other.

A series of small charts was next prepared, one for each storm-track, with the view of sorting them out, so as to group together those whose tracks resembled each other.

The total number of separate tracks which have been made out is 273, and it seemed of interest to find out how long each of these atmospheric disturbances lasted, *i.e.*, for how many days each was recognisable on the charts.

The result of this investigation is given in the subjoined table, which exhibits the distribution of the depressions as to months and as to duration:—

TABLE I.

	Duration of Depressions in Days.																			Monthly Totals.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	
1882.																					
August -	—	—	—	3	—	—	—	2	1	—	2	1	—	—	—	—	—	—	—	—	9
September -	1	—	3	1	2	1	1	2	1	1	—	—	—	—	—	—	1	—	—	—	14
October -	1	6	6	—	3	2	3	1	—	—	1	—	1	—	—	—	—	1	—	1	26
November -	3	2	—	2	—	1	2	—	1	—	1	1	—	1	—	1	—	—	—	—	15
December -	4	1	3	4	3	1	2	—	1	2	2	1	—	—	—	—	—	—	—	—	24
1883.																					
January -	3	2	4	2	4	2	—	2	—	1	2	—	—	—	—	—	—	—	—	—	22
February -	3	4	5	1	2	1	1	1	1	—	—	—	—	—	—	—	—	—	—	—	19
March -	7	3	7	2	3	6	2	1	—	—	—	—	—	—	—	—	—	—	—	—	31
April -	—	—	2	6	3	2	4	—	—	1	—	—	—	—	—	—	—	—	—	—	18
May -	3	5	1	2	3	1	1	—	2	4	—	1	1	—	—	—	—	—	—	—	24
June -	6	4	6	3	1	1	1	2	1	1	—	—	—	—	—	—	—	—	—	—	26
July -	4	5	2	6	2	2	1	2	—	—	—	—	1	1	—	—	—	—	—	—	26
August -	1	1	1	2	1	3	4	3	—	3	—	—	—	—	—	—	—	—	—	—	19
	36	33	40	34	27	23	22	16	8	13	8	4	3	2	—	1	1	1	—	1	273

It appears from this table that out of the 273 depressions, 143, or more than one half, lasted less than five days. The instances of duration of more than 10 days were rare, and those lasting more than 13 days extremely so, and almost entirely confined to the autumn months, September, October, and November. One of these was the storm which Mr. H. Harries considers he has traced from the Philippine Islands to the Baltic, over a distance of 14,000 miles (Quart. Journ. R. Met. Soc., vol. xii., p. 10).

Looking at the monthly distribution, the disproportionately small number of tracks noted in August 1882 attracts notice, but this is possibly in some measure attributable to the fact that in the first month the number of observers was not as large as it subsequently became.

As regards the number of these depressions which were traceable across the Atlantic so as to reach our coasts, and cause serious gales, the Note in last year's Report shows that this was insignificant.

The number of depressions which appeared over the Atlantic to the southward of the parallel of 40°, the latitude of Philadelphia, during the period of 13 months, was 63, thus distributed:—

	No. of Depressions appearing South of Lat. 40°.	No. of the Depressions in Col. 1, which passed from Long. 60° to Long. 0°.
1882.		
August - - - -	1	0
September - - -	4	3
October - - - -	7	1
November - - - -	5	2
December - - - -	7	1
1883.		
January - - - -	8	2
February - - - -	1	0
March - - - -	9	0
April - - - -	4	2
May - - - -	5	1
June - - - -	4	0
July - - - -	3	1
August - - - -	5	2
	63	15

The second column shows the number, 15 in all, of these, which, starting beyond the 60th meridian, crossed the Atlantic, though some passed the meridian of Greenwich in very high latitude, and it will be seen that these were fairly equally distributed over the year. When, however, we take those which took their rise in lower latitudes below 35° N., we find traces of periodicity. This is to be expected, when it is remembered that this class includes the West India hurricanes. The columns have the same meaning as before.

	No of Depressions appearing below Lat. 35°.	No. of Depressions in Col. 1, which passed from Long. 60° to Long. 0°.
1882.		
August	0	0
September	2	2
October	5	1
November	4	2
December	1	1
1883.		
January	2	1
February	0	0
March	1	1
April	2	1
May	2	1
June	0	0
July	0	0
August	4	2
	23	12

Out of these 23 disturbances, 12, or more than one half, possessed sufficient energy to cross the ocean. When such a phrase is used it must not be understood to imply that the cyclonic system had throughout its course, or even at any part of it, sufficient energy to be ranked as a storm or to have been a source of danger to shipping, but it would certainly have produced disturbances of weather when it approached our coasts.

We see, therefore, that of the depressions appearing near the American coast south of 40° N., nearly one fourth crossed the Atlantic, but that those appearing south of 35° N. had greater vitality, more than one half living until they reached the meridian of 20° W.

Another point of interest was to trace the instances in which disturbances showed themselves over the Central or Eastern Atlantic, near the Azores or Canaries. Of these one appeared in each of the months January to July inclusive, and none in any other month.

Another subject which appeared to present features of interest was the circumstance that occasionally depressions proceeding from the Temperate Zone passed up into Baffin's Bay, and eventually died out there. This phenomenon did not take place in the winter months, from October to March inclusive, but for the other

months the list of occurrences is as follows: the length of time for which the system remained within the article circle is given in each case :—

September - -	1	5 days.
April - -	1	3 days.
June - -	2	Each 4 days.
July - -	2	One 15 days, the other 3 days.
August - -	1	4 days.

The fact that as many as seven cyclonic systems absolutely died out gradually when they reached high latitudes, from apparent failure of energy, is a point not without some interest in the study of the origin and subsequent maintenance of these atmospheric whirls.

An attempt was also made to study the anticyclones or areas of high barometrical readings. It seemed impracticable to study the position of the entire areas enclosed on each day by the isobars of 30·0 or even of 30·1 inches, as these frequently embraced nearly the entire area of the maps. The isobar of 30·2 inches was then selected, as indicating the regions where the excess of barometrical pressure was most strongly accentuated, and as enclosing areas which were manageable.

A map was then drawn for each day on tracing paper showing the positions of these areas. These maps were then combined for successive days, by the method of a sort of composite portraiture and the several areas for the different days were drawn in different coloured chalks, the same sequence of colour being preserved throughout, and the last chart of each series being always reproduced as the first of the next.

It was found that, as a general rule, not more than three days could be combined without confusing the pictures.

These combination maps were then again combined in order to see what evidence was procurable of movement of the areas of excessive barometrical pressure (those of 30·2 inches and upwards) in the middle latitudes of the charts. It was not apparently of importance to trace those north of latitude 60° or even those over Europe, as both of these classes frequently passed beyond the limits of the charts.

Thus much, however, has become apparent that the area of excessive barometrical pressure, the Atlantic anticyclone, which lies over the Atlantic to the westward of the Canary Islands for the greater part of the year, is constantly being replenished by travelling anticyclonic areas which advance slowly from the westward. They move, therefore, in the same general direction as the cyclonic disturbances, the depressions, but at a much slower rate.

The number of such areas that have been definitely traced as advancing from the western portion of America to the Central

Atlantic during the 13 months is 15, and the dates of their first appearances are as follow :—

	1882.	November 29.	April 2.
	August 30.	December 4.	„ 8.
	September 13.	„ 9.	July 17.
	October 6.		August 1.
	„ 16.	1883.	„ 13.
	„ 25.	March 9.	„ 25.

It will be seen that no motion of the nature indicated above was noticed between the middle of December and the beginning of March, nor again during May or June.

As regards these periods, during the winter the belt of readings above 30·2 ins. generally stretched across the Atlantic from Africa to North America. In January this was occasionally interrupted, but from February 1 to 21 there was hardly any change noticeable in this anticyclonic area, as far as the portion lying over the Atlantic is concerned.

As regards the second period, the reason that no anticyclones started from America to travel eastwards at that time is apparently that during the month of May, and June particularly, there was hardly a day on which areas of 30·2 ins. showed themselves over the United States.

In conclusion, it must be said that the endeavour to connect paths of anticyclones with paths of cyclonic disturbances at the same date by any obvious relation such as parallelism, &c., has not been successful.

NOTE B.

MEMORANDUM on the MEASUREMENT of SQUALLS shown on the TRACES yielded by ROBINSON ANEMOMETERS of the "STANDARD" PATTERN: submitted to the COUNCIL by RICHARD H. CURTIS, F.R.Met.Soc.

IN attempting to make measurements of squalls from the traces yielded by our standard-pattern anemometers, it is necessary to bear in mind three points connected with the instrument itself, each of which tends to limit the amount of reliance which can fairly be placed upon the results obtained, and also to make the operation of measuring more or less one of difficulty.

The first of these points is the cramped time-scale of the curves, in which an hour is represented by a space of less than four-tenths of an inch, strictly by ·365 inch.

The second is the enormous reduction undergone by the revolutions of the cups before they are registered upon the papers. The circular path of the centre of one of the cups is 12·57 feet, and therefore since we still adopt Dr. Robinson's factor (3) for the relation between the velocity of the cups to that of the wind, one revolution of the cups is taken to indicate a horizontal movement of the air of 12·57 yards, and 7,000 revolutions will be required for the passage of every 50 miles of wind over the cups:—12·57 × 7,000 = 87,990 yards = 50 miles very nearly. But by means of a train of wheels this number of revolutions of the cups is reduced to *one*, and causes one turn of the cylinder carrying the spiral pencil which makes the trace upon the paper as a piece of line 2·75 inches in vertical length.

The third point is also very important, namely, that the trace itself which is made by the pencil on the paper is not a fine, sharply-defined line, such as might be made by a pointed pencil, but a broad and rather ill-defined mark about ·04 inch wide, produced by the combined movements of the spiral pencil as it is turned by the wind upon the paper, and of the paper as it is moved under the pencil by the clock.

The method adopted for tabulating the anemograms is to measure the number of miles recorded during 60 consecutive minutes. By this system we practically obtain the mean velocity for the hour, and the plan is therefore not adapted for giving a just idea of a gale, either as regards its maximum strength or its gustiness, the latter being a most important point to determine in any inquiry as to the destructive power of a gale.

It is quite true that it is only within certain limits that the traces of the Robinson anemometer can be used for obtaining information on these points, but an examination of the traces themselves will readily show that in many cases a great deal more can be got from them than is at present sought for.

In nearly every curve there may be seen certain deviations of a more or less marked character in the angle which the trace makes with the time lines. Each of these indicates a variation in the velocity of the wind, and they are therefore, under certain circumstances, of considerable importance, *e.g.*, as when it is desired to ascertain whether, during a gale, the wind attained to an extreme strength, beyond anything, that is to say, which the hourly totals measured would indicate. These features of the curves are sometimes very marked with strong winds, and it is these which we are accustomed to speak of—I think erroneously—as "squalls."

But the ordinary squall, the sudden isolated gust of wind, lasting generally for only a few seconds, is of far too brief duration to produce any appreciable effect upon a trace made under such conditions as those just pointed out, and therefore it may be said at once that singly they cannot be detected upon these anemograms. No doubt during the continuance of such gusts the velocity of the cups becomes very high indeed; but even assuming it to reach such a rate as 250 miles per hour, in which case the cups should make 10 revolutions per second, and to maintain that rate for 15 seconds—which is probably an extremely liberal allowance in both directions—we should then register only one mile of wind, which would be shown by a piece of trace only ·055 inch in length and almost as broad as it was long.

There is no doubt that gales of wind differ a good deal in character as regards the prevalence of squalls, some being remarkable for the frequency and strength of the gusts while in others this feature is comparatively rare. The records of the "bridled" anemometer, however, enable us to learn a good deal about them, and of the way in which they probably influence the anemograms of the "Robinson" cup instrument. What ordinarily takes place seems to be much as follows:—

First of all there is a fluctuation of the wind within certain limits (which varies in nearly every gale) above and below the average strength, the variations following each other in quick succession so that even on the bridled anemogram, which has a very open time-scale, it is impossible to pick out any individual one except when the exceptionally wide time-scale, which can be used when desired, is in operation. The resulting trace is a broad mass of shading produced by the rapid oscillations of the pencil, the width of the belt of shading depending upon the average strength of these minor gusts.

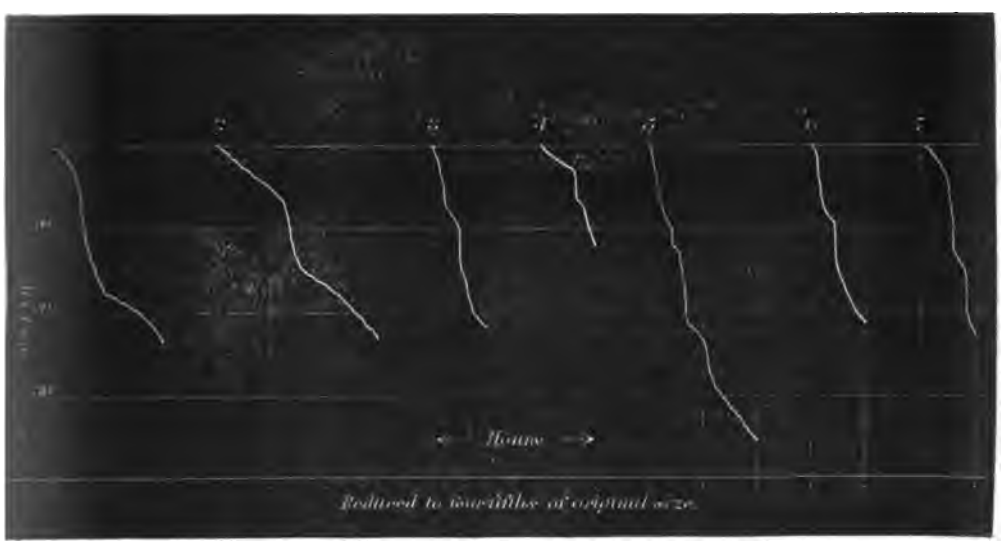
In addition to these, there are always a number of heavier gusts which cause the pencil to pass beyond the upper limits of the shaded belt, and which occur at longer intervals, say of a few minutes, although not unfrequently a number of them will succeed each other very quickly. The strength and frequency of these squalls varies very much in different gales, in some being only rarely experienced, while in others they are extremely frequent and violent,—with perhaps a few of very exceptional strength.

The very open time-scale which can be used at pleasure with the bridled anemometer allows these variations of force to be distinctly seen and followed.

From this, therefore, it would seem that the main portion of the traces of the Robinson instrument is really built up of a succession of tiny pieces of line inclined at varying angles to the hour-lines, but each piece so small that with the conditions under which the trace is made they cannot be separately distinguished, and they therefore form in the aggregate a line which roughly approximates more or less to a straight line, and which by summing up the gusts and lulls gives at least an approximation to the *average* velocity over the period selected for measurement.

When, however, the squalls are more than usually heavy and frequent, they are able to produce an effect upon the trace of the Robinson instrument which can be distinctly seen, the inclination of the trace being altered over a space sufficiently great to allow in many cases of its being measured with considerable accuracy. These are the appearances of the line which we commonly call "squalls," but which would probably be more correctly described as due to a *succession of squalls* rather than to one.

That these deviations of the line are sufficiently well defined to be readily recognised and dealt with, and that they are also of sufficient importance as to be worthy of measurement, the following specimens traced from a few Holyhead and Yarmouth curves will show :—



1. Yarmouth, December 20, 1887.
2. „ „ 20, 1886.
3. Holyhead, October 9, 1886.
4. „ September 17, 1886.
5. „ January 10, 1889.
6. „ May 28, 1886.
7. „ November 20, 1888.

The first of these examples shows how easily the hourly measurements may give a totally wrong idea of the wind-force:—two consecutive hourly measurements of 11 miles each were recorded here, the temporary increase of velocity being divided between them, and in this way the fact that for a portion of the time the velocity was fully 35 miles per hour was hidden altogether.

With reference to the method which should be adopted for measuring these "squalls" it is clear that, first of all, care must be taken to avoid any chance of mistaking deviations of the line due to mechanical defects for those really caused by augmentations of the wind velocity. This, however, is easily guarded against by a little intelligent inspection of the curve, since such faults nearly always repeat themselves at corresponding portions of every line. Further, since with high velocities, very small differences of angle in the trace make large differences in the corresponding velocities, no piece of line should, as a rule, be measured which is under certain minimum dimensions, say, of 10 minutes of the horizontal, or of 10 miles of the vertical scale.

For the measurements themselves the plan which I have myself adopted appears to me, after a good many trials of it and of others, to be the best and easiest, viz., to lay a line etched on a glass plate fairly along the centre of the portion of trace to be measured, and by means of an arc attached to the line to note the angle it makes with the time-lines, and then from a table of corresponding velocities take out the hourly rate to which it is equivalent.

For the purpose, however, of quickly deciding whether a piece of trace reaches the given minimum limit of 10 miles in 15 minutes, which the Council recently decided to fix, I have upon the same scale etched a line enclosing a space of 10 minutes in one direction and of 10 miles in the other, and this being moved across a curve will readily show whether any portion of it reaches the minimum fixed.

In conclusion, however, I would like to add that although these "squalls" are really indications of important increases of wind-force—caused by actual revolutions of the cups and not due to mechanical eccentricities,—yet it ought to be remembered that absolutely nothing is at present known about instrumental errors at such high velocities as they indicate; and further that, when with lower velocities we speak of so many miles per hour, we quote velocities which we know to be too high, since all recent investigations have shown Dr. Robinson's factor to be about one-sixth too great.

APPENDIX.

APPENDIX I.

LIST of CAPTAINS (and Officers) who have sent in Logs classed as "Excellent" during the year ending March 31, 1889. The figures opposite to each show the total number of such Logs which they have returned to the Office during the period that they have been observing.

Captain's Name.	Number of "Excellent" Logs.	Ship.
Adamson, A. W. - -	6	S.S. "Kaisar-i-Hind."
Alderton, T. J. - -	4	S.S. "Brindisi."
Aldrich, Pelham, R.N. -	16	H.M.S. "Egeria."
Atkinson, S. P. H. - -	8	"Prior Hill."
Balfour, Lieut. Andrew, R.N. -	28	H.M.S. "Rambler."
Barker, D. Wilson, F.R.Met. Soc.	11	S.S. "International."
Becket, Alexander - -	10	"Amana."
Belding, R. - - -	1	"Atlantic."
Bennett, E. C. - - -	13	"Thessalus."
Blackburn, Mr. H. S. - -	6	S.S. "Rohilla."
Bourke, Edmund G., R.N., F.R. Met. Soc.	6	H.M.S. "Hyacinth."
Bright, H. - - -	3	"Beltana."
Briscoe, R. F. - - -	2	S.S. "Kaisar-i-Hind."
Brown, E. - - -	3	"Moorhill."
Buchan, James - -	20	"Oban Bay."
Cameron, J. G. - -	8	S.S. "Adriatic."
Campbell, Hugh - -	7	"Zemindar."
Campbell, Robert - -	2	S.S. "Elton."
Carr, H. C. - - -	8	"Superb."
Chaddock, E. T. - -	1	"Elvira."
Chaddock, G. A. - -	5	"Elissa."
Clapp, Staff Comr. E. S., R.N.	8	L.H. Tender "Richmond."
Clark, Alexr. - - -	1	S.S. "Cardiganshire."
Clarke, Commr. A. C., R.N. -	2	H.M.S. "Espiègle."
Clarke, James - - -	10	S.S. "Olbers."
Couper, William - -	1	"Clackmannanshire."
Craig, E. A. - - -	1	S.S. "Claymore."
Crighton, A. T. - -	3	S.S. "Colina," and SS. "Circe."
Cromarty, D. S. - -	2	"Cassandra."
Crowley, C. - - -	2	"Alexander Lawrence."
Crutchley, W. C., R.N.R. -	16	S.S. "Kaikoura."
Dart, L. C. - - -	9	"Alcester."
Dawson, Comr. L. S., R.N. -	6	H.M.S. "Sylvia."
Douglas, Lt. H. H., R.N. -	6	H.M.S. "Sylvia."
Draper, R. - - -	6	S.S. "Monarch."
Dunbar, J. I. - - -	14	S.S. "Arracan."
Dyke, A. H. - - -	2	S.S. "La Plata."
Dyke, H. W. - - -	6	"Accrington."

Captain's Name.	Number of "Excellent" Logs.	Ship.
Ellery, William - -	19	"Talookdar," "Majestic," and "Holkar."
England, Thomas -	7	"Jane."
Exham, T. K., F.R.A.S. -	3	S.S. "Esk."
Field, Lieut. and Comr. A. M., R.N.	3	H.M.S. "Dart."
Fraser, W. D. - - -	3	"Thomas S. Stowe."
Fullarton, D. - - -	4	"Timaru."
Gordon, James - -	14	S.S. "City of Agra."
Graham, W. V. - -	5	"Bolan."
Gray, David - - -	15	S.S. "Eclipse."
Gray, John - - -	12	S.S. "Hope."
Haselwood, R. W. B. - -	2	S.S. "Kaisar-i-Hind" and S.S. "Rohilla."
Hepworth, C. M. W., R.N.R., F.R.Met. Soc.	7	S.S. "Port Pirie."
Hicks, G. M. - - -	1	S.S. "Nile."
Hird, W. - - -	4	"Marlborough."
Hoskyn, Comr. R. F., R.N. -	17	H.M.S. "Myrmidon."
Hughes, W. P. - -	9	"Candahar."
James, W. D., Esq. - -	1	"Lancashire Witch."
Janes, George - - -	3	"Middlesex."
Jennings R. C. - -	1	S.S. "Colina."
Jones, Richard - r	2	"Thomas Hilyard."
Jones, S. Griff - -	7	"Hermine."
Kemp, A. H. - - -	2	"Hudson."
Kiddle, Sub-Lieut. E. W., R.N.	3	H.M.S. "Egeria."
King, J. W. - - -	3	"Philomene."
Leportier, T. - - -	8	S.S. "Mira."
Long, Mr. J. C. - -	4	S.S. "Kaisar-i-Hind."
Machugh, R. H. - -	3	S.S. "Ching Wo."
McLean, Archibald - -	6	S.S. "Concordia."
Marshall, Frederick - -	4	"Berkshire."
Maxwell, Joseph - -	4	"Oamaru."
Mesnard, Thomas - -	7	"Sierra Miranda."
Millican, J. W. - -	3	"Myrtle Holme."
Milne, W. F. - - -	6	S.S. "Esquimaux."
Milner, W. H. - - -	5	S.S. "Avon."
Moignard, Philip - -	3	"Astoria."
Molony, E. J. - - -	7	"British Merchant."
Moore, W. U., R.N. - -	13	H.M.S. "Rambler."
Munn, L. A. - - -	1	S.S. "Durban."
Murdoch, Peter - -	9	"Sierra Lucena."
Murray, Alexr. - -	6	S.S. "Perseverence."
Newton, Mr. T. C., F.R.Met. Soc.	5	S.S. "Minia."
Norman, Francis - -	6	"Cape Clear."
North, W. G. - - -	10	S.S. "Tiger."
Parry, Moses, F.R.Met.Soc. -	13	S.S. "Prydain."
Parson, G. F. - - -	8	"Earnock."
Pearson, C. W. - -	28	S.S. "Strathleven."
Peebles, R. - - -	13	"Bracadale."
Powles, F. W. - - -	3	S.S. "Essequibo."
Pritchard, Lieut. C. E., R.N. -	3	H.M.S. "Espiègle."

Captain's Name.	Number of "Excellent" Logs.	Ship.
Quaile, D. W. A. - -	3	"Orissa."
Randall, William - -	10	"Laomene."
Read, G. W., F.R.G.S. -	4	S.S. "Auretta."
Richardson, Mr. W. H. -	3	S.S. "Auretta."
Rigaud, H. C. - - -	1	S.S. "Derwent."
Ritchie, Alexander - -	1	"Four Winds."
Rowsell, P. - - -	1	S.S. "Tagus."
Russell, C. J. - - -	9	"Khyber" and "Belfast."
Sargent, A. H. - - -	4	"Glenlora."
Scott, George - - -	4	"Houghton Tower."
Shearer, George - -	9	"Thetis."
Simpson, Alexander - -	10	S.S. "Australasian."
Smith, Lieut. F. B., R.N. -	7	H.M.S. "Myrmidon."
Spooner, I. D. - - -	1	S.S. "Tamar."
Spratly, W. - - -	12	S.S. "Mozart."
Sturdee, H. K. - -	11	L.H. Tender "Richmond."
Swinton, W. W. - -	1	"Banffshire."
Thompson, J. E. - -	2	S.S. "Monarch."
Trott, Samuel, F.R.Met.Soc. -	13	S.S. "Minia."
Trunks, H. - - -	3	"Aldborough."
Walker, Henry - -	10	S.S. "Cephalonia."
Waring, William - -	15	S.S. "Breconshire."
West, Frederick - -	2	S.S. "Port Adelaide."
Wheaton, N. J. - -	8	"Eliza."
Wilson, John - - -	3	S.S. "Ethiopia."
Wilson, W. - - -	4	"Horsa."
Woolward, Robert - -	3	S.S. "Don" and S.S. "Nile."

Names of observers deceased printed in italics.

APPENDIX II.—Ships supplied and Documents returned during the year ending 31st March 1889.

The number of merchant ships supplied with standard instruments and meteorological logs during the above period was 136.

The number of meteorological logs, and documents from Foreign Stations, received during the same period, and registered in the Office, amounted altogether to 381, of which 240 were returned from ships, and the remainder from land stations, outside the British Isles.

List of Documents received from Foreign Land Stations.

Place.	Observer.	No. of Documents.	Nature of Observations.
Abaco (Bahamas)	C. H. Bode and T. R. Thompson, Lightkeepers.	3	"Lighthouse" Register, July 1887 to December 1888.
Akassa, Nun River, Niger Delta	Frank Russell, F.R.G.S.	6	Two observations daily, December 1887 to October 1888.
Barbados (Commercial Hall)	J. C. Bellamy	3	"Lighthouse" Register, July 1887 to December 1888.
„ (Joe's River House)	R. B. Walcott, M.D., F.R. Met. Soc.	3	„ „ „ „
Bathurst (Gambia)	I. M. Harrison	1	Two observations daily, November 1888.
Beyrout (Lee Observatory)	R. H. West, M.A.	12	Two observations daily, February 1888 to January 1889.
Breaksea Island (King George's Sound).	H. K. Toll, Arthur Robinson, and W. Lindfield.	2	"Lighthouse" Register, July 1885 to December 1886; February to September 1888.
Brooklyn, New York	S. A. Dunn	1	Three observations daily, January to July 1887.
Cape Pembroke (Falkland Islands)	G. K. Broom, Lightkeeper	2	"Lighthouse" Register, January to December 1888.
Cay Lobos (Bahamas)	N. H. E. Garner, Lightkeeper	3	„ „ July 1887 to December 1888.
Cay Sal (Bahamas)	T. R. Thompson, Lightkeeper	2	„ „ „ „
Famagusta (Cyprus)	G. Eliades	3	Two observations daily, July 1887 to June 1888; 1887, March to December.
Gaboon River	Louis Borgela and L. Milcent, West African Tel. Co.	8	One observation daily, 1888, February to November.
George Town (British Guiana)	Robert Ward	11	Two observations daily, 1888, March to December; 1889, January, February.

LIST of DOCUMENTS—*continued.*

Place.	Observer.	No. of Documents.	Nature of Observations.
Gibraltar - - - -	Corporal O. Baldwin and Staff-Sergeant Spackman, Med. Staff Corps.	11	Two observations daily, March 1888 to January 1889.
Grand Bassam - - -	A. Jouve and G. Baillan, West African Tel. Co.	4	„ „ „ 1888, February to March, and October to December.
Great Basses - - -	Lightkeepers - -	1	Eight observations daily, February and March 1888.
Heligoland - - -	J. J. Friederichs, Lightkeeper	12	Two observations daily, March 1888 to February 1889.
Inagua (Bahamas) - -	Lightkeepers - -	3	"Lighthouse" Register, July 1887 to December 1888.
Kapalama (Honolulu) - -	Henry Cobb Adams -	10	Two observations daily, February to July, September to December 1888; January 1889.
Kyrenia (Cyprus) - -	C. Natai and M. Fuleiham	3	Two observations daily, 1887, March to December.
Larnaca (Cyprus) - -	W. Hoad and G. P. Voudiziano.	3	„ „ „ „ „
Limassol (Cyprus) - -	Luigi Béraud - -	3	„ „ „ „ „
Little Basses - - -	Lightkeepers - -	1	Eight observations daily, January to March 1888.
Minicoy - - - -	„ - - -	1	Eight observations daily, March to April 1888.
Nicosia (Cyprus) - -	G. Stephen - -	3	Two observations daily, 1887, March to December.
Papho (Cyprus) - - -	E. A. Malliotis - -	3	„ „ „ „ „ „
Point King (King George's Sound)	S. Mitchell - - -	2	"Lighthouse" Register, July 1885 to December 1886; April to September 1888.
São Thomé (West Africa) -	E. Hurdus - -	5	Two observations daily, 1888, April to November.
Sombrero - - -	J. A. Richardson, Lightkeeper	1	"Lighthouse" Register, 1887, June to November.
Suva (Fiji) - - -	J. D. W. Vaughan, F.R.Met. Soc.	2	One observation daily, 1887, February to June, August to December; 1888, January, February.
Teneriffe (San Antonio) - -	W. L. Boreham - -	3	Two observations daily, November and December, 1888; January, February 1889.
Trinidad - - - -	J. H. Hart, Supt. Botanic Gardens.	10	Two observations daily, 1888, February to December.

List of Documents received from Ships.

Captain's Name.	Ship.	Voyage.	Year.
[1] Adamson, A. W.	S.S. Kaisar-i-Hind	Calcutta, viâ Suez	1888
[2] Alderton, T. J.	S.S. Brindisi	" "	1888
[3] Aldrich, Pelham, R.N.	H.M.S. Egeria	Mauritius, King George's Sound, Hobart, Sydney, and Auckland	1887–88
[4] " "	"	Australia	1888
[4] " "	"	"	1888
Anderson, Charles	S.S. Achilles	China, viâ Suez	1886–87
" "	"	" "	1887–88
[5] Armstrong, G. B.	S.S. Elbe	River Plate	1888
Asquith, W.	S.S. Deucalion	China, viâ Suez	1886–87
" "	"	" "	1887
" "	"	" "	1887–88
Atkinson, S. P. H.	Barque Priorhill	Port Elizabeth, Lyttelton	1887–88
[6] Bailey, T. S.	Drumcraig	Melbourne, Newcastle (N.S.W.), San Francisco	1887–88
[7] Barker, D. W., R.N.R., F.R. Met. Soc.	S.S. International	Massowah, viâ Suez, Naples	1887–88
Batt, H.	S.S. Hector	China, viâ Suez	1887
"	"	"	1887
Becket, Alexander	Amana	" " Cape Town, Newcastle (N.S.W.), San Francisco, Port Townshend (W.I.), Melbourne	1887–88
Belding, R.	Barque Atlantic	Buenos Ayres, Valparaiso, Talcahuano	1887–88
" "	"	Buenos Ayres, Port Nolloth	1888–89
Bennett, E. C.	Thessalus	Sydney, San Francisco, Portland (Or.)	1887–88
Bigley, W. B.	S.S. Diomed	China, viâ Suez	1887
Bourke, Comr. Edmund, R.N.	H.M.S. Hyacinth	Panama and coast of Chili and Peru	1887–88
"	"	Chile, Sandwich Islands	1888
Brehant, G. J.	Barque Achievement	Callao, Iquique	1887–88
Bremner, A. W.	S.S. Ulysses	China, viâ Suez	1886–87
Bright, H.	Barque Beltana	Adelaide, Newcastle (N.S.W.), Tahiti	1888–89
Brisco, R. W.	Barque Ponemah	Callao, Coquimbo, Baltimore, Bull River, U.S.A.	1887–88
[1] Briscoe, R. F.	S.S. Kaisar-i-Hind	Calcutta, viâ Suez	1888
[1] " "	" "	Bombay, viâ Suez	1888–89
Brown, E.	Barque Moorhill	Paysandu, Monte Video, Pernambuco	1888
Brown, R. J.	S.S. Titon	China, viâ Suez	1887
Buchan, James	Barque Oban Bay	Monte Video, Esquimalt, Astoria	1887–88
[8] Buckler, J. H.	S.S. Dee	West Indies	1888
Butler, S. H.	S.S. Priam	China, viâ Suez	1886–87
" "	"	" "	1887
" "	"	" "	1887–88
[9] Cameron, J. G.	S.S. Adriatic	New York	1887–88
" "	"	"	1887–88
[10] Campbell, Archibald	S.S. Circassia	"	1887–88
Campbell, Hugh	Zemindar	Calcutta	1888
[11] Campbell, Robert	S.S. Elton	India viâ Suez	1888
" "	"	" "	1888
" "	"	" "	1888–89
Carr, H. C.	Superb	Melbourne	1887–88
[12] Chaddock, E. T.	Barque Elvira	Altata (Mexico)	1888–89
Chaddock, G. A.	Barque Elissa	Rosario, Mauritius, Bombay, Chittagong	1887–88
" "	" "	Mauritius, Kurrachee, Rangoon, Boston	1888
" "	" "	Rangoon, Boston, Cadiz	1888–89
Chrimes, H.	S.S. Sarpedon	China, viâ Suez	1887

Captain's Name.	Ship.	Voyage.	Year.
[13] Clapp, Staff-Comr. E. S., R.N.	Schooner Richmond -	Bahamas - - - -	1887–88
" " "	" " -	" - - - -	1888
" " "	" " -	" - - - -	1888
[14] Clark, Alexander -	S.S. Cardiganshire -	China and Japan, viâ Suez -	1888
[15] Clarke, Comr. A. E., R.N.	H.M.S. Espiègle -	Madeira, Monte Video, Sandy Point, Port Otway, and Coquimbo - - -	1887–88
[15] " " "	" " -	Coquimbo, Valparaiso, Honolulu, Esquimalt - - -	1888
Clarke, James -	S.S. Olbers - -	West coast of South America -	1888
Couper, William -	Clackmannanshire -	Adelaide, Wallaroo - -	1887–88
Craig, E. A. -	S.S. Claymore - -	China, viâ Suez - - -	1888
Crighton, A. T. -	S.S. Colma - -	Quebec - - - -	1887
" " -	S.S. Circe - -	" - - - -	1888
Cromarty, D. S. -	Barque Cassandra -	Sydney, Port Augusta - -	1887–88
Crowley, C. - -	Barque Alexander Lawrence.	Sydney, Wilmington, Portland (Oregon) - - -	1887–88
" " - -	" " "	Sydney - - - -	1888–89
[16] Crutchley, W. C., R.N.R.	S.S. Kaikoura -	Cape Town, Hobart, Lyttelton, Rio Janeiro, Santa Cruz -	1888
[16] " " "	" - -	Cape Town, Hobart, Wellington, Rio Janeiro - - -	1888
Dart, L. C. - -	Alcester - - -	India - - - -	1887–88
[17] Dawson, Comr. L. S., R.N.	H.M.S. Sylvia - -	Red Sea, Gulf of Volo - -	1888
[18] Dickinson, L. R. -	S.S. Elbe - -	River Plate - - -	1888
[19] Draper, R. - -	S.S. Monarch - -	Coast of British Isles - -	1888
Dunbar, J. I. -	S.S. Arracan - -	India, viâ Suez - - -	1887–88
" " -	" - -	" " - - -	1888
" " -	" - -	" " - - -	1888–89
Dunlop, George -	S.S. Belair - -	West Indies - - -	1887
[20] Dyke, A. Hart -	S.S. La Plata - -	South America - - -	1888
[21] " " -	" - -	West Coast of South America -	1888–89
Dyke, H. W. -	Accrington - -	Calcutta, Mauritius, New York -	1885–88
Ellery, William -	Talookdar - -	Calcutta - - - -	1887–88
" " -	Majestic - -	" - - - -	1888
" " -	Holkar - -	" - - - -	1888–89
England, Thomas -	Barque Jane - -	Matanzas (Cuba), Philadelphia, Havana, Buenos Ayres, Ship Island, Pascagoula - -	1887–88
Exham, T. K., F.R.A.S.	S.S. Esk - -	West Indies - - -	1888
" " -	" - -	" - - - -	1888
[22] Field, Lieut. and Comr. A. M., R.N.	H.M.S. Dart - -	Australia - - - -	1888
[22] " " "	" - -	Townsville, Cooktown, New Guinea	1888
[22] " " "	" - -	Sydney, Tasmania - - -	1888
Fordyce, William -	County of Haddington	Calcutta - - - -	1887–88
Fraser, W. D. -	Barque Thomas S. Stowe	Brisbane, Newcastle, N.S.W., Portland (Oregon) - - -	1887–88
Fullarton, D. -	Timaru - -	Auckland - - - -	1888
Gibson, M. - -	Jessie Readman -	New Zealand - - -	1887–88
[23] Gordon, J. - -	S.S. City of Agra -	Calcutta, viâ Suez - - -	1888
Gould, H. W. -	S.S. Ocean King -	New Orleans, Newport (Newfoundland), Bremerhaven, Norfolk (V. A.) - - - -	1888–89
[22] Graham, W. V. -	Bolan - - -	Calcutta - - - -	1887–88
Gray, David -	S.S. Eclipse - -	Greenland - - - -	1888
Gray, John - -	S.S. Hope - -	" - - - -	1888
Gray, Robert -	S.S. Port Phillip -	Australia, viâ Cape and Suez -	1888–89
Grier, J. K. - -	S.S. Antenor - -	China, viâ Suez - - -	1887
Grier, John - -	" - -	" - - -	1887
[25] Griffin, E. J., R.N.R.	S.S. Moor - -	Cape Town - - -	1888
[26] " " "	" - -	" - - -	1888

	Captain's Name.	Ship.	Voyage.	Year.
	Guthrie, W. E.	S.S. Bellerophon	China, viâ Suez	1886–87
	" "	"	" "	1887
	Hannah, W. T.	S.S. Glaucus	" "	1887
	" "	"	" "	1887
1	Haselwood, R. W. B.	S.S. Kaisar-i-Hind	India, via Suez	1888
27	" "	S.S. Rohilla	Calcutta, viâ Suez	1888–89
28	Hepworth, C. M. W., R.N.R.	S.S. Port Pirie	Adelaide, viâ Cape of Good Hope, Newcastle (N.S.W.), Java, Bangkok	1887–88
29	Hicks, G. M.	S.S. Nile	Buenos Ayres	1888
	Hird, W.	Marlborough	New Zealand	1887–88
	Horne, James	Loch Garry	Melbourne	1888–89
30	Hoskyn, Comr. R. F., R.N.	H.M.S. Myrmidon	Townsville, Sydney, Tasmania	1887–88
	Hughes, W. P.	Candahar	Calcutta	1887–88
	Hutchinson, John	S.S. Orestes	China, viâ Suez	1887
	" "	"	"	1887
31	Irving, P. J.	S.S. Celtic	New York	1888
	Jackson, Charles	S.S. Palamed	China, viâ Suez	1887
	" "	"	"	1887
	Jackson, M. H. F.	S.S. Telamon	"	1887
	" "	"	"	1887
	Jackson, T. S.	S.S. Palinurus	"	1887
	James, W. D.	Schooner Lancashire Witch.	Spitzbergen, Nova Zembla	1888
	Janes, George	Middlesex	Singapore, Chittagong	1888–89
	Jennings, R. C.	S.S. Colina	Montreal	1888
32	Jones, E. T.	S.S. Arab	Cape Town	1888
	Jones, Henry	S.S. Telemachus	China, viâ Suez	1887
	Jones, Richard	Thomas Hilyard	Rio Janeiro, Quebec	1888
	Jones, S. Griff.	Barque Hermine	Vancouver, Valparaiso, Taltol, Talcahuano	1888–89
	Kemp, A. H.	Barque Hudson	New Zealand	1887–88
	King, J. W.	Philomene	Mauritius, Adelaide, Newcastle (N.S.W.), Valparaiso, Rotterdam	1887–89
33	Lamb, O.	Iron Cross	New York, Chittagong, Salem (U.S.A.)	1887–88
	Lapage, W. P.	S.S. Anchises	China, viâ Suez	1887
	Lelean, J. E.	Barque Delscey	Valparaiso, Lobos de Afuera, Mauritius, Buenos Ayres, Chile	1886–88
	Leportier, T.	S.S. Mira	Calcutta, viâ Suez	1888
	" "	"	"	1888–89
	Lourison, G. M.	Eaton Hall	San Francisco	1888–89
	McGonnel, James	Barque Matilda C. Smith	Ensenada (Brazil), Mobile	1888–89
	Machugh, R. H.	S.S. Ching Wo	China, viâ Suez	1888
	" "	" "	" "	1888–89
9	McLean, A.	S.S. Concordia	Montreal	1887–88
	" "	" "	"	1888
	Marshall, Frederick	Barque Berkshire	Rangoon	1887–88
	Maxwell, Joseph	Oamaru	Auckland, Wellington	1888
	Mesnard, Thomas	Sierra Miranda	India	1887–88
34	Miller, A. T., R.N.	H.M.S. Conway	Birkenhead	1888
	Millican, J. W.	Barque Myrtle Holme	Adelaide	1887–88
	" "	" "	"	1888–89
	Milligan, John	S.S. Jason	China, viâ Suez	1887
	" "	" "	" "	1887–88
	Milligan, Samuel	" "	" "	1886–87
	" "	S.S. Stentor	" "	1887
	Milne, W. F.	S.S. Esquimaux	St. John's (Newfoundland), Davis Straits	1888
9	Milner, W. H.	S.S. Avon	West Indies	1888
35	" "	"	"	1888
36	" "	"	"	1888
35	" "	"	"	1888–89
	Mitchell, George	S.S. Trinacria	Naples, New York	1887–88
	" "	"	Naples, New York, Miramichi, Mediterranean Ports	1888

	Captain's Name.	Ship.	Voyage.	Year.
	Mitchell, John	Cape Verde	Vancouver, Melbourne, Wallaroo	1888
	Moignard, Philip	Barque Astoria	San Diego (Cal.), Tacomo (Puget Sound)	1887–88
	Molony, E. J.	British Merchant	Sydney, San Francisco	1888–89
[37]	Moore, W. Usborne, R.N.	H.M.S. Rambler	China Sea	1888
[37]	„ „	„ „	„	1888
[38]	Munn, L. A.	S.S. Durban	Cape Town	1888–89
	Munro, George	Barque Peeblesshire	Brisbane, Portland (Oregon)	1887–88
	Murdoch, Peter	Sierra Lucena	India	1887–88
	Murray, Alexander	S.S. Perseverance	Cumberland Strait	1887–88
	Nelson, R.	S.S. Menelaus	China, viâ Suez	1886–87
	„	„	„ „	1887–88
	Nish, H.	S.S. Cyclops	„ „	1886–87
	„	„	China, Madras, viâ Suez	1887
	Norman, Francis	Barque Cape Clear	Wellington (N.Z.), Newcastle (N.S.W.), Callao, Peru	1887–88
	North, W. G.	S.S. Tiger	Hamburg	1888
	„ „	„	„	1888
	„ „	„	„	1888–89
[39]	Owen, Owen	Barque Cordelia	Valparaiso	1887–88
	Parry, Moses	S.S. Prydain	Savona, Philadelphia, New Orleans, Norfolk (Va.), Antwerp, Civita Vecchia, Odessa	1887–88
	„ „	„	Odessa, Antwerp, Bremerhaven, Sevastopol, Constantinople	1888
[9]	Parson, G. F.	Earnock	Adelaide, Wallaroo	1888
	Pasifull, E. J.	Rahane	San Francisco	1888
	Pattman, R.	Loch Torridon	Calcutta and New York	1887–88
[40]	Pearson, C. W.	S.S. Strathleven	Yokohama, New York, viâ Suez	1888
	Peebles, Robert	Barque Bracadale	Calcutta	1887–88
	„ „	„ „	„	1888–89
	Powles, F. W.	S.S. Essequibo	West Indies	1888
	„ „	„	„	1888
[9]	„ „	„	„	1888
	Purdy, Thomas	S.S. Dardanus	China, viâ Suez	1886–87
	„ „	„	China, Madras, viâ Suez	1887
	„ „	„	China, viâ Suez	1887–88
[3]	Quaile, D. W. A.	Orissa	Townsville, San Francisco	1887–88
	Randall, W.	Laomene	Calcutta, Mauritius, New York	1888
[41]	Read, G. W., F.R.G.S., F.R.A.S.	S.S. Auretta	India, viâ Suez	1888
[41]	„ „	„	Odessa	1888
[41]	„ „	„	Genoa, Odessa	1888–89
	Reynolds, Robert, R.N.R.	S.S. German	Table Bay	1888
[42]	Rigaud, H. C.	S S. Derwent	Barbados	1888
	Riley, James	S.S. Ajax	China, viâ Suez	1887
	Ritchie, Alexander	Four Winds	India	1887–88
[43]	Rowsell, P.	S.S. Tagus	River Plate	1888
	Russell, C. J.	Khyber	India	1887–88
	„ „	Belfast	Calcutta	1888–89
	Rutherford, G. D.	Barque King Alfred	San Francisco, Portland (Or.)	1887–88
	Sargent, A. H.	Barque Glenlora	New Zealand	1888
	Saul, John	Barque Coronilla	Hobart, Port Pirie	1887–88
	Scale, R. F.	S.S. Laertes	China, viâ Suez	1886–87
	„ „	„	„ „	1887
	Scott, George	Hoghton Tower	Chittagong, Mauritius	1887–88
	„ „	„	Mauritius, Chittagong, St. Helena	1888
	Scougall, H.	Barque Tynron	Freemantle (W.A.), Mauritius, Adelaide, Port Natal, Melbourne	1886–88
	Shearer, George	Barque Thetis	Pisagua	1887–88
	Simpson, Alexander	S.S. Australasian	Melbourne, viâ Cape Town, Mauritius, Bombay, viâ Suez	1887–88
	„ „	„	Cape Town, Australia	1888–89

Captain's Name.	Ship.	Voyage.	Year.
Simpson Alexander	Barquentine Traveller	Greenland	1888
[64] Smith, J. H.	H.M.S. Worcester	Greenhithe	1887–88
[44] Spooner, I. D.	S.S. Tamar	West Coast S. America	1888–89
Spratly, William	S.S. Mozart	Monte Video	1887–88
" "	"	Monte Video, Buenos Ayres, Rio Janeiro	1888
Stewart, Alexander	County of Selkirk	Calcutta	1888–89
[45] Swinton, W. W.	Barque Banffshire	Brisbane, Wallaroo	1887–88
Thompson, A.	S.S. Patroclus	China, viâ Suez	1886–87
" "	"	" "	1887–88
[19] Thompson, J. E.	S.S. Monarch	Coast of British Isles	1888
Thompson, J. S.	S.S. Nestor	China, viâ Suez	1886–87
" "	"	" "	1887
[46] Trott, Samuel	S.S. Minia	Halifax	1887–88
[46] " "	"	"	1888
[46] " "	"	North Atlantic	1888
Trunks, H.	Barque Aldborough	Antwerp, Melbourne, Newcastle (N.S.W.), San Francisco	1887–88
[38] Tyson, John	S.S. Durban	Cape Town	1888
[47] Wait, A. McLean	S.S. Spartan	"	1888
[48] " "	"	Natal	1888–89
Walker, Henry	S.S. Cephalonia	Boston	1888
[49] Waring, William	S.S. Breconshire	China and Japan, viâ Suez	1888
[49] "	"	" "	1888–89
Webster, J. K.	S.S. Prometheus	China, viâ Suez	1886–87
" "	"	" "	1887–88
[50] West, Frederick	S.S. Port Adelaide	Yokohama, viâ Suez, Hong Kong, Vancouver, San Francisco, New York, West Point (Virginia)	1888–89
Wheaton, N. J.	Barque Eliza	Barbadoes, Minatitlan (Mexico)	1888
Wilding, James	S.S. Agamemnon	China, viâ Suez	1887
" "	"	" "	1887
[51] Williams, Henry	Dynomene	Philadelphia, Hiogo, Java	1887–88
Wilson, John	S.S. Ethiopia	New York	1888
" "	"	"	1888–89
Wilson, William	Horsa	Melbourne, Talcahuano, Pisagua	1887–88
[52] Woolward, Robert	R.M.S. Nile	West Indies	1887–88
[53] " "	S.S. Don	" "	1888

In cases distinguished by marginal numbers the Meteorological Registers were kept chiefly by Officers, as follows:—

[1] Kept by J. C. Long, R.N.R., Chief Officer.
[2] Kept by H. S. Blackburn, J. C. Babot, R. A. Lindan, and W. C. Templeton.
[3] Kept by Lieut. N. T. Chen, I.C.N., and Sub.-Lieut. E. W. Kiddle, R.N.
[4] Kept by Sub.-Lieut. E. W. Kiddle, R.N.
[5] Kept by R. J. Hingston, Chief Officer, and J. J. Henry, 4th Officer.
[6] Kept by J. A. Davies, 2nd Mate.
[7] Assisted by T. Dawson, Chief Officer, G. Lever, 2nd Officer, and G. Boothby, 3rd Officer.
[8] Kept by the Officers.
[9] Assisted by Officers.
[10] Kept by James Adams, 3rd Officer.
[11] Assisted by G. Maxfield and F. Simpson.
[12] Assisted by R. A. Newby.
[13] Kept by H. K. Sturdee.
[14] Kept by W. C. Mitchell and J. S. Bateman.
[15] Kept by Lieut. C. E. Pritchard, R.N.
[16] Kept by J. L. Berryman, 4th Officer.
[17] Kept by Lieut. H. H. Douglas, R.N.
[18] Kept by R. J. Hingston, Chief Officer, and J. J. Henry, 4th Officer.
[19] Kept by C. J. Hall, 3rd Officer.
[20] Kept by C. S. Tindall, Chief Officer, and A. W. Hackland, 3rd Officer.
[21] Kept by Arthur Hackland, 3rd Officer.
[22] Kept by W. H. Jones, Signalman.
[23] Assisted by D. Morrison and W. R. More.
[24] Assisted by Chief and Second Officers.
[25] Kept by J. V. Williams, 4th Officer.
[26] Kept by H. Strong and J. D. Williams.
[27] Kept by H. S. Blackburn, Chief Officer, and H. A. Cottrell, 5th Officer.
[28] Kept by Walter Newman, 2nd Officer.
[29] Kept by F. S. Newton, 2nd Officer.
[30] Kept by Lieut. F. Bowden Smith, R.N.
[31] Kept by J. J. Lossius and D. Kerr, 2nd and 3rd Officers.
[32] Kept by Mr. Brackenbury.
[33] Kept by Arthur Walter Tomlinson.
[34] Kept by the Cadets.
[35] Assisted by A. Jolliffe.
[36] Assisted by W. Persse, Chief Officer.
[37] Kept by Lieut. Andrew F. Balfour, R.N.
[38] Kept by Louis Wood Bayldon, 3rd Officer.
[39] Assisted by J. Stockman, Mate.
[40] Assisted by A. Keith, 2nd Mate.
[41] Kept by W. H. Richardson, 1st Mate.
[42] Kept by H. W. Beal, 2nd Officer.
[43] Kept by Edward Watt, 4th Officer.
[44] Kept by D. Constantine, 2nd Officer.
[45] Assisted by E. P. Dicks.
[46] Kept by T. C. Newton, F.R.Met.Soc., Chief Officer.
[47] Kept by Messrs. Kennedy and Mosley, 2nd and 3rd Officers.
[48] Kept by G. H. Dawson and E. Simmons, 4th Officers.
[49] Assisted by F. R. Newport and E. N. Reed.
[50] Kept by D. E. Jamieson, 2nd Officer, and F. Williams, 3rd Officer.
[51] Kept by Peter McCabe, 3rd Officer.
[52] Kept by F. S. Newton, 2nd Officer.
[53] Kept by Herbert Davis and G. P. Ellis.

APPENDIX III.

Instruments supplied, &c. to the Royal Navy.

Per Account.	Barometers.	Aneroids.	Thermometers.				Hydrometers.
			Ordinary.	Max.	Min.	Screens.	
April 1st, 1888, afloat	195	445	1,283	249	211	136	108
Issued since	60	118	384	57	55	29	33
	255	563	1,667	306	266	165	141
Returned since	65	108	412	44	39	23	63
April 1st, 1889, afloat	190	455	1,255	262	227	142	78

Instruments supplied, &c. for use at Naval Stations.

April 1st, 1888, in use	67	84	289	5	25	2	18
Issued since	2	20	51	17	2	1	—
	69	104	290	22	27	3	18
Returned since	10	40	98	5	9	—	6
April 1st, 1889, in use	59	64	192	17	18	3	12

Disposition of Admiralty Instruments on April 1st, 1889.

Afloat in Royal Navy	190	455	1,255	262	227	142	78
In use at stations	59	64	192	17	18	3	12
In store at M.O.	87	83	257	42	59	14	41
„ Chatham	7	3	20	6	5	4	9
„ Sheerness	15	19	44	16	15	9	15
„ Portsmouth	3	7	22	5	5	14	9
„ Devonport	1	4	23	1	1	—	20
„ Queenstown	2	5	21	1	1	—	8
„ Gibraltar	2	2	14	—	—	—	4
„ Malta	5	12	23	6	6	2	17
„ Bombay	5	3	10	2	3	1	—
„ Halifax	3	10	16	2	3	—	14
„ Bermuda	8	12	30	3	4	—	15
„ Jamaica	3	3	19	2	2	—	—
„ Cape of Good Hope	5	7	30	10	5	3	30
„ Trincomalee	3	1	1	2	2	—	—
„ Hong Kong	8	12	43	20	15	1	19
„ Coquimbo	4	7	26	3	2	—	19
„ Sydney	4	9	24	6	4	—	—
„ Esquimalt	2	4	22	3	3	—	—
Total, April 1st, 1889	416	722	2,092	409	380	193	310
Lost, &c. since April 1st, 1888	8	31	370	16	20	13	26
Under repair	—	4	—	1	1	—	—

APPENDIX IV.

INSTRUMENTS supplied, &c. to Mercantile Marine.

Per Account.	Barometers.	Compasses.	Thermometers.				Hydrometers.
			Ordinary.	Max.	Min.	Screens.	
April 1st, 1888, afloat - -	122	—	744	1	1	125	380
Issued since - - -	92	—	596	—	3	84	327
	214	—	1,340	1	4	209	707
Returned since - -	98	—	641	1	4	89	328
April 1st, 1889, afloat - -	116	—	699	—	—	120	379

INSTRUMENTS at Stations, viz., Telegraph Offices, Observatories, Fishing Villages, &c.

April 1st, 1888, in use - -	254	3	267	57	60	36	13
Issued since - - -	24	2	22	6	5	2	1
	278	5	289	63	65	38	14
Returned since - -	22	2	14	5	7	2	4
April 1st, 1889, in use - -	256	3	275	58	58	36	10

DISPOSITION of Board of Trade Instruments on April 1st, 1889.

In merchant ships - -	116	—	699	—	—	120	379
In use at stations - -	256	3	275	58	58	36	10
In store at M.O. - -	52	3	108	25	44	30	78
At Liverpool Agency -	7	7	49	—	—	7	23
„ Aberdeen „ -	4	—	33	—	3	5	24
„ Glasgow „ -	1	—	15	—	—	3	8
„ Dundee „ -	15	—	27	—	—	12	31
„ Hull „ -	7	—	29	—	—	9	24
„ Southampton „ -	2	—	8	—	—	—	1
„ Cardiff „ -	1	—	8	—	—	3	15
Total, April 1st, 1889 -	461	13	1,251	83	105	225	593
Lost, &c. since April 1st, 1888	12	—	169	2	7	15	75
At opticians - - -	1	—	6	—	—	—	—

APPENDIX V.

LIST of STATIONS reporting Meteorological Observations to the Office by Telegraph on 31st March 1889, with the Names of Observers.

*†Sumburgh Head	Rev. W. Brand	Minister of Dunrossness.
*†Stornoway	J. Forbes	Nicolson Institution.
Wick	J. Sinclair	Watchmaker.
Nairn	Miss Penny	School mistress.
*†Aberdeen	W. Boswell	Assistant at the Observatory.
Leith	W. Hay	Telegraph Clerk.
*†Shields	J. W. Irvine	Do.
Spurn Head	J. H. Watson¶	Lightkeeper.
†York	H. M. Platnauer, F.G.S.	Curator of Museum.
Loughboro'	W. Berridge, F.R.Met.Soc.	
†Ardrossan	J. W. Mayes	Telegraph Clerk.
Malin Head	O. O'Doherty§	Signalman, Lloyd's.
*†Mullaghmore	K. Kerr	Retired Coastguard Officer.
*†Belmullet	Miss M. J. Tolan	Telegraphist.
†Donaghadee	T. MacGowan	Postmaster.
Parsonstown	E. Haines	Assistant Observer at Lord Rosse's Observatory.
Barrow-in-Furness	W. S. Whitworth	Engineer, Barrow-in-Furness Railway.
*†Holyhead	Capt. Richards	Keeper of Sailors' Home.
Liverpool	J. Hartnup, F.R.Met.Soc.	Bidston Observatory.
*†Valencia	J. E. Cullum	Superintendent of the Observatory.
†Roche's Point	W. Kennedy	Telegraph Clerk.
Pembroke	S. Blake	Lightkeeper.
*†Scilly	W. Thomas	Signalman.
Prawle Point	W. Hewitt	Coastguard Officer.
†Hurst Castle	G. G. Appleton	Lightkeeper.
†Jersey	J. Fisher	Signalman.
*†Dungeness	P. Curnow‖	Lightkeeper.
*†London	F. Gaster, F.R.Met.Soc.	Clerk, Meteorological Office.
Oxford	W. Wickham	Radcliffe Observatory.
Cambridge	H. Todd	Observatory.
*†Yarmouth	G. T. Watson	Secretary, Sailors' Home.
‡Hawes Junction	W. H. Bunce	Station Master.

Note.—Those stations marked with an asterisk (*) report also at 2h. p.m.; and those with a dagger (†) at 6h. p.m.

‡ This station now reports by post only.

§ Mr. J. O'D. Farren left in January 1889.

‖ Mr. Curnow has since been removed to another lighthouse.

¶ Mr. J. B. Smith left September 1888.

APPENDIX VI.

REPORT OF INSPECTION OF THE IRISH AND WELSH STATIONS, 1888.

I have to report that I have completed the inspection of these stations, with three exceptions. *Armagh* where scarlet fever was in the house, *Foynes* and *Waterford* where I thought the inspection might be omitted this year.

TELEGRAPH STATIONS.

Holyhead, visited September 29.—There is nothing calling for remark at this station.

Parsonstown, visited October 1.—At this station there has been a change of observer, the present reporter Haines has only recently been appointed, and Dr. Bœddicker has kindly undertaken to instruct him.

Valencia, visited October 4.—There is nothing special to be remarked about the telegraphic service, except that the attendance at the local post office on Sunday mornings is not punctual. We have difficulty on this score at Malin Head also.

The electrical anemograph had been erected shortly before my visit. The registration of direction was not satisfactory at the date of my presence at Valencia.

I am sorry to say that the water obtained by the Abyssinian well which was sunk last year, though abundant in quantity, is so charged with peaty matter as to be unfit for domestic use. This is unfortunate, as it was unexpected, a well close at hand yielding water which is quite pure from peaty contamination, as that water runs through limestone gravel.

Roche's Point, visited October 5.—This station remains in good order. The light to the barometers is not good, and never will be while the house is unchanged.

Donaghadee, visited October 9.—The observations are well taken. I have arranged that a weathercock be supplied for erection on a flag-staff, the property of the observer.

Malin Head, visited October 12.—I am glad to say that Lloyd's are repairing the signal tower where the barometers are placed, which has hitherto been in a dilapidated condition.

Mullaghmore, visited October 15th.—This station was in very good order, as usual.

Belmullet, visited October 17.—This station continues to work well.

St. Ann's Head, visited October 25.—There is nothing calling for special remark at this station.

STATIONS OF THE SECOND ORDER AND WEEKLY WEATHER REPORT STATIONS.

Killarney (W.W.R. station), visited October 3.—Archdeacon Wynne was absent. The instruments were in good condition, and Miss C. Wynne, the second daughter, seemed capable and careful in registration.

Colebrooke, visited October 10.—This station was satisfactory.

Londonderry, visited October 11.—The exposure at this station is not so good as formerly, the observer has changed his residence, and his garden is not so open as that attached to his previous house.

Markree, visited October 16.—Mr. Marth has trained an assistant, Miss L. Frizelle, to take the readings, and during his absence in Germany in June last she managed the station satisfactorily.

Currygrane (*Edgeworthstown*), visited October 19.—This station has recently become one of the second order, having previously only furnished observations for the Weekly Weather Report. The observer is young, but seems very careful and anxious to learn.

Dublin, Glasnevin, visited October 23.—The observations are well taken. The exposure of the rain-gauge is not open enough, and I propose to supply another gauge to test the effect of exposure, as an open site is attainable.

Dublin (*Fitzwilliam Square*), visited October 23.—This station calls for no special remark. It continues to be the most satisfactory station we have, except as regards the exposure of thermometers and rain-gauge.

Dublin, Phœnix Park, visited October 23.—The only matter calling for notice here is that the observers have compiled for themselves a table of proportion between velocity and Beaufort's scale of wind, which is not satisfactory. A new one will be supplied to them.

Kilkenny, visited October 24.—The observations for the Weekly Weather Report are well taken.

St. David's, visited October 26.—This station is, as usual, in very good order.

I also visited the fishery barometers at Belfast, Bangor, Groomsport, Donaghadee, Valencia, Wicklow, and Kingstown, and took over new barometers for two stations in the co. Donegal, Kincaslagh (near Burton Port), and Portnoo (near Ardara). At Wicklow the barometer had air in the tube, which I removed.

(Signed) ROBERT H. SCOTT.

The following table shows the results of the thermometric comparisons:—

Corrections to be applied to the readings of—

STATIONS.	Dry Bulb.	Wet Bulb.	Max.	Min.	Spare Therm.	Remarks.
STATIONS OF THE SECOND ORDER.						
Brookeborough	−0·8	−0·9	−0·5	−0·4	—	
Dublin (City)	−0·1	−0·1	−0·1	−0·2	—	Grass min. +0·2.
Dublin (Phœnix Park)	−0·6	−0·4	−0·4	−0·3	—	Do. −0·3.
Edgeworthstown	−0·3	−0·2	−0·4	+0·3	−0·1	Do. +0·5. Spare ther. is a Kew standard.
Glasnevin	−0·1	−0·4	−1·0	+0·3	—	Grass min. +0·4.
Londonderry	−0·4	−0·4	0	+0·2	−0·5	
Markree Castle	−0·6	−0·4	−0·2	−0·2	—	
Parsonstown	−0·5	0	−0·6	−0·2	—	Grass min. −0·1.
St. David's	−0·1	−0·1	−0·2	0	—	Do. −0·1.
TELEGRAPHIC REPORTING STATIONS.						
Holyhead	0·0	−0·2	−0·4	+0·1	0	
Malin Head	−0·5	−0·5	−0·4	−0·3	−0·6	
Mullaghmore	−0·5	−0·4	0	−0·4	−0·7	
Belmullet	−0·7	−0·5	−0·3	−0·8	—	
Donaghadee	−0·1	−0·2	−0·2	+0·1	−0·1	
Parsonstown	−0·5	0·0	−0·4	−0·2	—	
Valencia	−0·9	−0·6	−0·6	+0·2	—	
Roches Point	−0·5	−0·5	−0·5	+0·2	—	
St. Ann's Head	−0·4	−0·2	−0·5	−0·7	−0·3	
WEEKLY WEATHER REPORT STATIONS.						
Kilkenny	—	—	−0·2	0·0	—	
Killarney	−0·6	−0·5	−0·2	0·0	—	

Report of Inspection of the Scottish Stations for 1888.

Barometers.

The inspector's mercurial Standard Barometer No. 532, which has been repaired, was taken with me on the tour of inspection. Unfortunately in driving from Kirkwall to Swanbister the horse came down, and the barometer was broken by the shock. Hence for the stations inspected after Wick, the barometers could not be compared with an inspector's mercurial standard.

The results of the inspection of these instruments, such as they are, are shown by the following table. I am able, however, to report that the barometers were all in good order and observed with the same accuracy as in former years.

	Inspector's Standard, corrected.	Not corrected.		Remarks.
		Rep. Baro.	Check Baro.	
	ins.	ins.	ins.	
Rothesay	29·953	29·958	—	
Laudale	—	29·968	29·974	Check barometer is 8 feet higher in flat above, where at the time temp. was 4°·7 higher.
Lairg	29·316	29·313	—	
Dunrobin	29·633	29·638	—	Temp. of rep. barometer was 1°·4 higher than standard barometer.
Wick	29·602	—	29·598	In house.
Do.	30·098	30·094	—	In shop, compared the following morning.
Swanbister	—	30·486	—	
Stornoway	—	30·292	30·288	
Nairn	—	30·360	30·360	
Aberdeen	—	—	30·158	The observatory barometer read 30·162.
Braemar	—	29·167	—	
Dundee	—	30·280	—	
Ardrossan	—	30·416	—	Check barometer in Saltcoats.
Leith	—	29·946	—	Do. in house.

Thermometers.

The thermometers at the various stations were compared in water with the Standard Thermometer No. 2395. The next table gives the "corrected readings of the standard" and the errors of each thermometer as ascertained by the comparisons made. None of the minimum thermometers were this year found to be out of order; and as regards the maximum thermometers, provision is now made, where required, against displacement of the index during high winds.

	Standard No. 2,395, Corrected.	Dry Bulb.	Wet Bulb.	Spare Thermometer.	Max. Thermometer.	Min. Thermometer.	Time in Water in Minutes.	Change of Temperature.	Remarks.
	°	°	°	°	°	°		°	
Rothesay	56·0	−0·1	0·0	—	+0·1	−0·4	130	Uniform	
Laudale	59·1	+0·2	+0·2	—	+0·2	+0·2	150	Do.	
Lairg	56·2	+0·1	0	—	−0·1	−0·1	90	Do.	
Dunrobin	58·1	−0·5	−0·4	—	+0·6	−0·6	130	−0·2	
Wick	54·5	+0·3	+0·4	—	−0·3	−0·1	75	+0·3	
Swanbister	58·6	0·0	+0·2	—	+0·2	−0·3	120	+0·3	
Stornoway	57·5	+0·5	+0·5	+0·3	−0·3	−0·5	120	+0·2	
Nairn	55·0	+0·6	+0·7	0	−0·1	+0·9	80	Uniform	
Aberdeen	57·0	+0·1	+0·1	—	+0·6	0	135	+0·4	
Braemar	59·0	+0·6	+0·4	—	0	−0·2	150	Uniform	
Dundee	54·7	+0·5	+0·6	—	+1·4	−0·2	75	Do.	
Ardrossan	55·0	+0·2	+0·2	—	−0·3	−0·3	105	+0·3	
Leith	52·0	+0·1	+0·5	—	+0·1	−0·4	50	Uniform	
Aberdeen, King's College.	57·0	—	—	—	0	−0·2	—	—	

Hygrometers.

In this inspection, as in the previous one, the dry and wet bulbs were read instantly on opening the thermometer screens, with the view of collecting data as to the condition in which these instruments are kept at the stations. The results, which are quite similar to those in last year's report, are not given in this report. It may, however, be noted that at Ardrossan, where the hygrometer was in fairly good order, the readings were 52°·4 and 50°·5, the difference being much smaller than might have been expected from the dry bracing air at the time. As the screen was at the time running wet with the heavy dew, the real hygrometric state of the air could not be observed by the dry and wet bulbs in the screen.

Notes on the Stations.

Rothesay, August 30th, 1888.—The instruments were all in good order, and are observed with great care and intelligence.

Laudale, September 1st.—The instruments were in excellent order, and are, on the whole, well observed.

Fort Augustus, September 4th.—A hasty visit was made to this station during the interval it took the steamer to pass the locks at Fort Augustus, when I found everything in excellent order.

Lairg, September 5.—The instruments were all in good order, and are very well and carefully observed. The observer makes good use of his position, as ground officer for the Duke of Sutherland, in noting some of the more prominent effects of the weather on the growing crops.

Dunrobin, September 6.—The instruments were in very good order, and the observations were carefully made.

Wick, September 6.—The instruments were in good order, and the observations made with care and intelligence.

Swanbister, September 8.—Mr. Fortescue being from home at the time of my visit, his maid servant, aged 17, who was in charge, accompanied me round the instruments, including the anemometer, read them, and answered all questions put to her regarding their manipulation, &c. with remarkable intelligence. Everything was in excellent order.

Stornoway, September 12.—The instruments were in excellent order, and particularly well observed; Miss Riddoch, the first assistant, made the observations and prepared the telegram with correctness and despatch, and Miss Forbes, the second assistant, observed the instruments correctly, and is being taught to make up the telegram.

The wind observations were gone into with care in connexion with the queries received from the Office regarding the wind observations of the previous observer.

Nairn, September 13.—The instruments were in good order, and read by Miss Penny and the two assistants with particular care. The grass plat in the garden where the instruments are has been considerably extended. The Stevenson screen had recently been repaired by Mr. Penny in a workmanlike manner and is in good order.

Aberdeen, September 17.—The instruments were removed from Mr. M'Cormack's, the late observer, to Mr. Boswell's in the beginning of July. One of the barometers, No. 537, has been hung beside the old standard barometer of the observatory, the other one, No. 538, in Mr. Boswell's house. The Stevenson screen has been placed in Mr. B.'s garden, and the rain-gauge beside the thermometers in King's College grounds.

The instruments were in excellent order, and in all respects well attended to and observed.

Braemar, September 18.—The scale of the maximum thermometer, which has been in use for 30 years, has become very indistinct, and cracked in various directions, rendering a new one desirable. All the other instruments were in good order and well attended to, and read expertly and correctly by both observers.

Dundee, September 19.—The instruments were in very good order, and well attended to and observed. The wind observations continue to be accurately made, both as respects force and direction.

Ardrossan, September 20th.—As Mr. Mayes removes to Ardrossan in May next, better arrangements will be made for utilizing the check barometer. The rain-gauge requires extensive repairs, the nails holding its outer casing to the wooden box having been rusted out three months previously.

The observations were carefully and correctly made by Mr. M. and his assistant.

Leith, October 29th.—The instruments were in very good order, and attended to, observed and reported with conscientious care.

Dunrossness.—This year the station was inspected by Mr. Dickson while in that part of Shetland, inspecting the Fishery Barometers. He reported that the errors of the thermometers were in accordance with previous reports, and the readings of all the observers were accurately made.

Aberdeen, King's College Observatory, September 17th.—Everything here was in excellent order, and the work of the observatory appeared to be well attended to.

(Signed) ALEXANDER BUCHAN.

INSPECTION OF OBSERVATORIES AND ANEMOGRAPHS.
1888.

THIS year I have visited the observatories at Aberdeen, Glasgow, Oxford, and Stonyhurst, and inspected the anemographs at Fleetwood, North Shields, Swanbister, and Yarmouth.

Aberdeen, visited September 4th.—The instruments were all examined and duly cleaned where necessary, as usual, the schedule of examination notes being also filled in. A Stonyhurst discharger, after it had undergone adjustment at Kew, was fitted to the Beckley rain-gauge.

The reference standard thermometers, as well as the maximum and minimum thermometers for eye observations, were tested at their freezing points by means of melting ice, and their readings found to be as follows:—

Dry standard, No. $\frac{397}{458}$	−32·0
Wet „ No. 395	−32·6
Max., M.O. 1002	−32·0
Min. $\frac{5056}{M.O.89}$	−32·0

The minimum thermometer is not in good repair, the fitting piece at one extremity of the tube being replaced by putty.

The Richard barograph having had a new pen fitted, I re-adjusted the zero to the barometric pressure as indicated by the standard.

Glasgow, September 14th.—I examined, and with the aid of White's men, cleaned all the meteorological instruments at this observatory. I found all in proper repair and in good condition, with the exception of the anemograph, the fan spindle of which is almost worn out.

The thermometers were compared with Kew Standard 682, with the following results:—

Corrections to	dry-bulb standard, No. 550 - -	—0°·4
„	wet „ „ „ 472 - -	—0·6
„	Standard barometer, Att. Th. K.O. 2479	—0·7
„	Barograph thermometer, B.T. -	—0·9
„	Maximum, No. 58,846 - -	0
„	Minimum, No. 63,942 - -	—0·2

Stonyhurst, September 20th.—All the instruments were found to be in good order, and carefully kept. The joints of the anemograph shafting were, however, somewhat loose, but were improved by forcing the pins home harder in the Hook's joints. One Robinson cup is loose on its axis, and the spindle was found to be a good deal worn. This Mr. Carlile remedied by grinding the bearing up again.

The thermometers were compared with Kew Standard 682, with the following results:—

Corrections to	dry-bulb standard, No. 619 - -	—0°·2
„	wet „ „ „ 382 - -	—0·5
„	maximum, M.O. 439 - - -	—0·3
„	minimum, B.T. 501 - - -	+0·2

Radcliffe Observatory, Oxford, September 25th.—The instruments at this observatory were all in good order, and working properly. Mr. Wickham alluded to a difficulty he had had with the cylinder clips breaking, and mentioned the desirability of having duplicate cylinders for use under such circumstances.

I compared the thermometers with my standard, with the following results:—

Correction to	Radcliffe dry-bulb standard of reference, No. 576 - - - -	—0°·3
„	Radcliffe wet-bulb standard of reference, No. 575 - - - -	—0·4
„	Stevenson's screen, dry-bulb, No. B.T. 1710 - - - -	—0·4
„	Stevenson's screen, wet-bulb, No. 1709 -	—0·4
„	barograph thermometer, No. 12,259 -	—0·2

ANEMOGRAPH.

Yarmouth.—The anemograph was inspected on August 28th and 29th. Unfortunately the weather was very stormy at the time, and it was not easy to dismount it entirely under the circumstances. I found, however, that the instrument was in good order, well oiled, and carefully kept. The cups and stays are much worn, and will require to be replaced by new ones next year; one stay had quite given way, but I repaired it with wire; the fans are quite perfect. The registering apparatus is in excellent order, the clock having been recently cleaned by a local watchmaker.

North Shields, August 30th and September 1st.—This instrument is well cared for by Captain Harrison, the light-keeper, who is assisted by a local mechanic who well lubricates it every three months. I entirely dismounted it and had every part cleaned and oiled.

The recorder having become somewhat dusty by material fallen from the old brickwork in the tower, I took that also to pieces, as well as the clock, and got all cleaned. At the same time I had some of the pivot holes in the clock re-bushed by a watchmaker so as to improve its going, which was not quite satisfactory.

Swanbister, Orkney.—This instrument was inspected September 10th. Mr. Fortescue takes great care of it, and it is kept well oiled and painted. I thoroughly dismounted and cleaned it.

Mr. F. had observed that heavy rain had during the winter entered the cup at the top of the velocity shaft, and, by displacing the oil, filled it with water, which in subsequently freezing had stopped the instrument during frost. I requested him to be particular in replacing the plug in the oil hole after oiling, in order, if possible, to prevent the recurrence of this accident.

Fleetwood.—The instrument was examined on September 21st and 22nd and found to be in good order throughout. Being in a building open to the public, I found the anemograph is looked upon with much interest by the visitors, but owing to the care of Mr. Gaulter and the keeper of the pavilion, it has not suffered any damage at their hands.

(Signed) G. M. WHIPPLE.

DEAR SIR, Kew Observatory, November 17, 1888.

I BEG to hand you herewith my report to the Meteorological Council regarding the condition of their self-recording instruments at the Valencia and Falmouth observatories, as well as for the anemograph stations at Holyhead and at Mountjoy barracks, Dublin.

Holyhead, visited October 1st–2nd.—At this station the anemograph was in good working order, and is evidently well cared for. The external parts of the instrument I had dismounted, and carefully examined the same, but neither the fans nor the cup arms showed any signs of wear. After cleaning and replenishing the bearings with fresh oil, the orientation was examined, and the observer was instructed to orientate the instrument once a month and forward the result to the Meteorological Office.

Mountjoy Barracks, October 3rd.—The anemograph here was going satisfactorily, but the clock badly required cleaning. This was duly done, and the other parts of the instrument were cleaned and all the bearings oiled, with the exception of the direction brake, which had only been quite recently attended to.

The orientation was tested, and the observer instructed to perform the operation monthly and send result to the Office.

Valencia, visited October 6th–10th.—As is usual at this observatory all the instruments were in good order.

The clocks of both the barograph and thermograph were taken to pieces and cleaned and new lines attached. The lenses, condensers, &c. received the usual cleaning, and the zero dots were shifted to the winter position. At the time of my visit the photography was very good, but owing to a considerable amount of stray light falling upon the thermograph cylinder, the sheets were discoloured; this, however, was entirely got rid of by the re-blackening of both the dry and wet tubes.

With regard to the definition of the wet-bulb trace in a certain part of the scale this cannot be improved, as has already been pointed out in previous reports.

In both instruments the action of the light stop was slightly prolonged, so that now in the case of the thermograph the light is cut off at two minutes before the even hour and comes on again at four minutes past the hour, whereas for the barograph the stop comes into action at four minutes to the even hour and ceases at two minutes past the hour.

The thermometers were compared by means of a Kew standard thermometer No. 682 at 55 degrees, and their correction found to be as follows :—

Dry, Standard 399	−0°·8
Wet, Standard 398	−0·6
Maximum, M.O. 1003	0
Minimum, 2497	−0·3
Standard barometer, attached thermometer, 71,062	−0·1
Barograph thermometer (no number)	−2·1

The rain-gauge was taken to pieces and cleaned, a new line attached and a Stonyhurst discharger fitted and adjusted to same.

Anemometer.—The external parts of this instrument were entirely taken down and cleaned, and the bearings replenished with fresh oil.

Falmouth, visited October 15th–19th.—Everything here was carefully tended and in good order. The anemometer was completely dismounted and all parts cleaned, the different bearings afterwards being replenished with fresh oil. The cup stays showed no signs of wear, but two blades of one of the fans were found loose; these I had resoldered before again erecting the instrument.

The clock was taken to pieces and cleaned, and the orientation examined, the sheet being sent herewith.

As regards the barograph and thermograph, the usual cleaning of the clocks was performed and the lenses and other parts attended to. The photography was excellent, but the thermograph sheets were more or less discoloured owing to stray light; this was, however, effectually remedied by the re-blackening of one of the tubes. At the time I noticed that the dry and wet dots of light were not quite vertically one over the other on the cylinder; this was duly put right.

In the case of the barograph, a slight alteration was made in the action of the light stop.

The thermometers were compared with Kew Standard No. 682, and found to have the following corrections at 63 degrees :—

Dry, standard 383	−0·75
Wet, Standard 388	−0·45
Maximum, M.O. 104	−0·6
Minimum, M.O. 308	−0·2
Barograph thermometer (no number)	−0·8
Standard barometer, attached thermometer (no number)	−0·9

The rain-gauge clock was taken to pieces and cleaned, and a new line attached, while at the same time a Stonyhurst discharger was fitted and adjusted to the instrument. With reference to the slight sagging of the pencil-trace towards midnight I was unable to detect the cause; it was certainly not due to faulty attachment of the paper, as this was carefully examined and by measurement found accurately adjusted to the cylinder.

To R. H. Scott, Esq., F.R.S. (Signed) T. W. Baker.

REPORT of INSPECTION of some ENGLISH STATIONS in 1888.

TELEGRAPHIC REPORTING STATIONS.

Dungeness, December 5th, 1888.—The instruments generally were in good order. One of the stays of the rain-gauge funnel had gone, which prevented it from being quite horizontal; this Mr. Curnow promised to have repaired.

The four light-keepers take it in turns to have charge of the higher low light, two to each light. The two in charge of the high light take the observations; they change at noon on Fridays. Messrs. Curnow and Batton were on duty during my visit, and seemed to understand the work well. They both set and read the barometer rightly.

Messrs. Jenkin and Cutting are the other two light-keepers. I asked Messrs. Curnow and Batton to go through the instruments with them when they came on duty, so as to insure that the others are as correct as themselves.

Hurst Point, November 12th.—The barometers agreed well, and the observer was very correct in his reading. The thermometers were very correct excepting the minimum and spare one, which had errors of −·8 and −·7 respectively.

It was blowing a gale and raining heavily, and the markings of the thermometers were very indistinct, so that my comparisons here were not so good as they generally are. I requested Mr. Appleton to *blacken the scales* and compare the thermometers again on a lighter and quieter day, and to send in the result to the Office.

Both Mr. Appleton and Mr. Gentry, who acts in his absence, seem well up in the work.

Jersey, November 14th.—The barometers agreed well, and the observer's reading agreed with my own to a thousandth. The thermometers were generally higher than the standard, the dry-bulb had a large error (−·7), and the spare one was 1°·1 too high; this Mr. Ley had detected, and had made it the spare one on that account. Mr. Fisher seems to understand his work very well; he has not been able to find anybody to act for him in case of his absence, but says he never goes away.

The sunshine recorder has been shifted to a suitable place on Mt. Leroux. I tested its accuracy as well as I could with compass and level. The sun was not shining. It seemed to be correct.

Scilly (*St. Mary's*), November 7th.—Mr. Thomas did his work well, and his son read and corrected the barometer rightly.

The barometers agreed well, and it will be seen that Mr. Thomas's readings agreed with mine. All the thermometers excepting the minimum had large minus errors. The index of the minimum had slipped to 32°. Mr. Thomas said it had done so before, so I raised the bulb end a little by tying a thick piece of string round its rest.

The anemometer is much exposed, and moisture unavoidably gets into its works whilst the paper is being changed. Would advise that a second barrel be provided on which the paper can be fixed in a sheltered place, then the glass door need only be open during the short time required for changing the barrel. Would construct a sheltered place under the ladder where the barrel might be prepared. Mr. Thomas tells me that the paper sometimes gets so wet that the pencil tears it. I think this exposure accounts for the defective markings which are complained of.

North Shields, November 22nd, 1888.—The observations seem to oe very carefully taken, and Mr. Irvine takes great interest in the work; he is well represented by Messrs. Clarke and Moat in his absence. One of these gentlemen set and read the barometer quite correctly in my presence.

The wet-bulb thermometer was rather loosely fitted; re-fitted it, and explained the best method to Mr. Irvine.

The anemometer seemed in good order, and Captain Harrison showed me how he managed it and its record.

Spurn Head, November 24th, 1888.—The instruments were in good order.

Went through the special questions on the notes with Mr. Watson, and found that he quite understands how to carry up the last decimal point of the barometer. He read and corrected the barometer to M.S.L. and 32° quite rightly. Unfortunately the assistant keeper (Mr. Grainger), who acts in Mr. Watson's absence, had had an accident, and I could not test his powers.

The rain-gauge glass is badly cracked.

Yarmouth, November 27th, 1888.—The barometers differed about ·03, but they seemed to work well, and to be in good order.

The maximum thermometers read too high, but it was probably due to the water having been colder than the air, and the index not having been shaken down before reading. I am afraid this may have affected my maximum readings in other cases, as I was not sufficiently careful on that point.

The wet-bulb was very dirty though moist. I re-fitted it and explained how it should be done in future.

The rain-gauge was 3 feet 5 inches above the ground, which seemed necessary on account of neighbouring walls.

The anemometer seemed to work very well. Mr. Watson pointed out a good place for a sunshine-recorder on the roof of the Sailors Home, if such observations were needed in that neighbourhood.

York, November 21st, 1888.—The reporting barometer seemed to work well; the check (No. 138) read about ·16 too low, and had been fixed at one reading for some time. Found the wet-bulb thermometer very roughly fitted; re-fitted it and explained how it should be done.

For note on sunshine recorder, see Stations of the Second Order report.

Weekly Weather Report Station.

Arlington Court, November 10th, 1888.—There is no barometer at this station. The thermometers were fairly correct. The wet-bulb was not well fitted, but I refitted it in the presence of Mr. Carter, the head gardener, who looks after the instruments, and seemed very willing to do his best.

Stations of the Second Order.

Eastbourne, December 7th, 1888.—The instruments are placed as explained in the last report. They belong (I understand) to the town authorities.

The anemometer is on the inland-side of a round tower, and does not project much above its edge, so that I should think its winds are much affected by the tower.

The barometer has a defective vernier, which needs repair, and I advised Mr. Sheward to compare it with another available barometer

for a week, so as to find the differences, and then to send *his* instrument to be repaired, using the other in its place.

The wet-bulb was dirty and not well fitted.

The rain-gauge is iron and very rusty, with a copper or brass rim and a curved pipe; its frame is defective, having one side driven in by a stone which had been thrown at it, but it works correctly.

The solar radiation thermometer and sunshine recorder are on the top of a high hotel.

Epsom, December 11th, 1888.—Found the instruments at this station well placed and generally in good order. The damp-bulb was not well fitted and it was dirty; re-fitted it with fresh cambric and lamp cotton, and explained how it should be done in future.

The direction of the wind had been observed by holding up a pocket-handkerchief. Drew a *true* north and south line, and explained how the direction of the wind is better got by considering the motion of the *lowest* clouds and of smoke, as well as by its direct action on the observer himself.

Mr. Jackson seemed anxious to do good work, and he has an able and willing assistant in Mr. Montgomery, one of the senior pupils. Mr. Jackson's college work is increasing, and he finds it more and more difficult to devote his own time to meteorological work.

Market Rasen, November 26th, 1888.—Mr. Jevons, who is a chemist in the town, did not give any particular reason for stopping his observations, but promised to commence regularly on December 1st. He quite understood the work, and will, I think, become a good observer. One of his assistants undertakes the work in his absence. His instruments are in good order and well placed.

St. Leonards, December 6th, 1888.—Dr. Colborne's instruments were well placed, and he read them very correctly.

He was taken ill in April, and then ceased observing at 9 p.m. He hopes to get the assistance of the gardener who is in charge of the public garden where the thermometers are placed, and to start regularly the 9 p.m. observations again. He is paid something by the town authorities for this work.

The sunshine recorder is somewhat out in adjustment, but it is so firmly cemented on to an iron pillar that it cannot be adjusted. In some cases the observer is obliged to slip the card into the lower part of its groove *only*, otherwise the focal point would fall on the frame instead of on the card. It was well placed in the Waterworks, and had a good range. The man in charge of the works looked after it; he seemed very intelligent.

Southampton, November 13th, 1888.—The barometer was poorly placed for bringing the quicksilver up to the ivory pointer, but Mr. Cook seemed to find no difficulty, and our readings of the vernier agreed. The maximum thermometer had rather a large error.

Everything was in first rate order at this station, and Mr. Cook takes great interest in the work.

Ketton Hall, Stamford, November 26th, 1888.—The instruments here belong to Mr. Coventry, who has been living with his brother-in-law, Mr. Hopwood, the owner of the place. Mr. Coventry is about to leave the place, and thinks it probable he will leave the instruments with the head gardener.

When I arrived, both Mr. Coventry and the head gardener (Mr. Divers) were absent. Mr. Tunnington, the second gardener, took me round.

The barometer was locked up in the head gardener's house, and not available. The thermometers had very small errors.

Mr. Coventry arrived before I left, and told me he applied no errors to his printed observations.

As Mr. Coventry was about to leave the neighbourhood and he had not decided what he should do with the instruments, I did not think it advisable to spend another day merely to see the barometers. Mr. Tunnington, the second gardener, seemed very intelligent. He expressed the wish for a sunshine recorder, showing that he was not afraid of the work.

York, November 21st, 1888.—I found the instruments at this station in fair order, except the wet-bulb, which was roughly fitted. See Telegraphic Station report.

The sunshine recorder was supported by rough wooden legs over the ridge of the roof of a school; it was kept in position by wire braces. It was cemented firmly into a frame which made it impossible to adjust it. It was much out in level E. and W. I think it should have a much firmer foundation to stand upon, and that it should not be cemented into a frame, but that space should be left for slight adjustments, which I am inclined to think would be best done by screws worked by means of a key which could be taken away. The position was rather difficult of access, but it seemed to have a good range. Unfortunately, Mr. J. E. Clark, who has charge of the instrument, was absent, but it was shown to me by an intelligent scholar who helps him.

(Signed) HENRY TOYNBEE.

BAROMETER and THERMOMETER READINGS.

NAMES OF STATIONS.	BAROMETER.	THERMOMETER.					
	Difference of Observer's from Inspector's Readings.	Temperature in Water.	DRY BULB. Correction to reduce to Inspector's Standard.	WET BULB. Correction to reduce to Inspector's Standard.	MAXIMUM. Correction to reduce to Inspector's Standard.	MINIMUM. Correction to reduce to Inspector's Standard.	SPARE OR GRASS. Correction to reduce to Inspector's Standard.
		°	°	°	°	°	°
Scilly (St. Mary's)	0	53·2	−·8	−·7	−0·9	−·3	−0·9†
Arlington Court	No barom.	47·5	−·1	−·4	−·1	+·4	None
Southampton	0*	52·5	−·5	−·6	−1·0	0	−·3‡
Hurst Point	−·001	52·2	−·2	−·2	0	−·8	−·7§
Jersey	−·001	54·6	−·7	−·3	−·4	−·1	−1·1§
York	+·001	50·0	−1·0	−·7	−1·0 (a.m. 8) −0·5 (p.m. 9)	0 (a.m. 8) 0 (p.m. 9)	None
North Shields	+·001	49·9	−·3	−·1	−·2	+·9	−·1§
Yarmouth	0	49·2	0	−·5	−1·8	+·4	−·1§
Spurn Head	+·001	52·4	−·6	−·5	−·4	−·2	None
Market Rasen	0	44·5	−·1	−·4	−·8	+·6	−·6§
Ketton Hall	Barometer not available.	48·0	+·2	+·2	+·1	+·4	Not put in water.‡
Dungeness	+·004	55·1	−·1	−·1	0	−·1	None
St. Leonards	0	52·7	−·5	−·7	−·1	0	None; grass min. used as min.
Eastbourne (vernier defective)	−·003	53·1	−·1	−·1	−·4	0	None
Epsom	−·002	51·0	−·6	−·2	0	−·3	−0·3§

* This merely relates to the setting of the vernier, the setting of the ivory point was too obscure to me, as the surface of the quicksilver was too cloudy to cast a reflection. Mr. Cook did it by actual contact and seemed correct.

† Used for sea water. ‡ Grass minimum. § Spare.

REPORT OF INSPECTIONS (ENGLAND).

Prestwich, a Weekly Weather Report and Second Order Station.—Inspected on December 3rd. Barometer has been shifted to a better position; thermometers are in an exceptionally good position and are very good instruments. Rain-gauge fairly good and well exposed. The minimum thermometer was slightly out of order, but this was soon rectified. Observer appears to take great interest in the work.

Barrow-in-Furness, a Telegraphic Reporting Station.—Inspected on December 5th. Barometer had air in tube which I expelled; tube, however, requires "re-boiling" as soon as arrangements can be made to have it done. Thermometer screen needs moving to a more open position. Rain-gauge worn out; new one at once supplied by observer. Wind observations (though apparently defective at first sight) are, I believe, quite accurate.

The testing of the thermometers seems to show that the following corrections are necessary to reduce their indications to true values:—

—	Dry Bulb.	Wet Bulb.	Max.	Min.	Terrest. Rad.	Temp. at Time.	Time in Water.
	°	°	°	°	°	°	
Prestwich - -	−0·5	−0·3	−0·4	−0·4	−0·2	46·7	1 hour.
Barrow-in-Furness -	−0·7	−0·5	−0·6	−0·1	—	52·1	1 hour.

FREDC. GASTER.

SIR, Meteorological Office, December 11, 1888.

I BEG to hand you herewith my report and inspection notes respecting the Stations of the Second Order at Uttoxeter and Sutton Coldfield.

Uttoxeter, October 5th.—This is a new station. The barometer is a good one, but the thermometers are all unverified instruments, and are not graduated on the stems. The screen is a rough imitation of Stevenson's, and was not well exposed. The rain-gauge was not firmly fixed and the measuring glass was damaged. At present the evening observations are so frequently omitted as to render the station almost useless, and I fear this difficulty cannot be overcome.

Sutton Coldfield, November 21st.—This is also a new station, but with a complete set of excellent instruments, the property of the Corporation. The barometer is hung in the town hall, on the tower of which (70 feet high) is a small anemometer, and a Jordan Sunshine Recorder. The thermometers and rain-gauge are on the lawn in front of the observer's house, about half-a-mile from the town hall. The screen was painted green at the time of my visit, but will be painted white. The observer (Mr. Fletcher, C.E., borough surveyor) takes great interest in the work. He is very willing to supply tabulations of sunshine if desired to do so.

The following table shows the results of the thermometric comparisons:—

Corrections to be applied to the reading of—

Stations.	Dry.	Wet.	Max.	Min.	Spare.	Remarks.
Uttoxeter - -	+·4	+1·2	—	—	+·3	
Sutton Coldfield -	−·1	−·1	−·1	−·1	—	

(Signed) JOHN A. CURTIS.

R. H. Scott, Esq., F.R.S.

APPENDIX VII.

METHOD of DEALING with TELEGRAPHIC WEATHER INTELLIGENCE.

THE operations connected with the preparation and issue of the Forecasts and Storm Warnings have not undergone any material change with regard to the home stations, but the work in connection with the information received from the United States has terminated. The Daily Weather Report has not been altered during the year.

The Office still receives, when the telegraphic communications are perfect, fifty-nine reports every morning, seventeen every afternoon (except on Sundays), and twenty-nine each evening, the arrangement of which is explained in the reports for the past two years.

At the British and Irish stations the morning observations are taken at 8 a.m. Greenwich time, and most of the telegrams arrive in London at about 9 o'clock, when the Intelligence Department of the Post Office extracts from them the portions required for its wind and weather reports. They are then transmitted to the Meteorological Office by its private wire.

As the reports come in, the information is entered on a chart, showing for each station at 8 a.m. the barometrical and thermometrical readings, with their respective alterations during the preceding 24 hours, the direction and force of the wind, and the state of the weather, together with any changes of importance which may have been noticed in the course of the preceding day. This information has been supplemented since January 1st by the subsequent insertion of the reports from all the stations in Russia, Central, Southern, and South-western Europe, which appear in the Bulletin International. From this chart others are drawn for publication in the newspapers and the Weekly Weather Report as described further on.

If necessary telegraphic warnings of storms or of atmospherical disturbance are immediately sent to our own coasts and to foreign countries. A brief telegraphic resumé of the weather is despatched shortly after 10 a.m. to the Harbour Authorities and the Chamber of Commerce in Jersey. Another telegraphic message, of about 75 words, is sent to the Underwriters' Association, Liverpool, containing reports of the pressure, wind and weather at 14 stations on the coasts of the British Islands; and a third message of about the same length is forwarded to the Central News and to the Exchange Telegraph Company for distribution in the provinces. The last of these messages consists of a brief statement of the general condition of weather over Western Europe, as shown by the morning reports. It is, however, not in the morning only that storm warnings are issued to the coasts, a constant watch being kept during the day; and, whenever, on the receipt of the regular or of special telegrams, the condition of the weather appears to be threatening, cautionary messages are at once issued to such parts of the coast as are thought to be menaced by a gale.

Forecasts of the weather, for a day in advance, are prepared each morning, afternoon, and evening; these are drawn up for eleven districts in the British Islands, and issued to subscribers, to certain Clubs, and to many of the London and Provincial newspapers in accordance with the arrangements referred to on p. 10. The districts

for which the Forecasts are prepared are those into which the returns for the Weekly Weather Report are grouped and are shown below.

0. SCOTLAND, NORTH.
1. SCOTLAND, EAST.
2. ENGLAND, N.E.
3. ENGLAND, EAST.
4. MIDLAND COUNTIES.
5. ENGLAND, SOUTH.
6. SCOTLAND, WEST (with Isle of Man).
7. ENGLAND, N.W. (with North Wales).
8. ENGLAND, S.W. (with South Wales).
9. IRELAND, NORTH.
10. IRELAND, SOUTH.

About an hour and a quarter is occupied in the preparation and transmission of the provincial and foreign telegrams, and in the drawing up of the "Remarks" and the 11 a.m. Forecasts for the London newspapers, so that the MS. copies for these papers are ready for issue soon after 11 a.m.

Charts are prepared daily for newspaper publication as follows:—

For the "Times," - -	two, viz.:	for 8 a.m. and 6 p.m.
For the Patent Type Founding Company, on behalf of the "Shipping Gazette," and for distribution to the provincial press -	one	for 8 a.m.

The 8 a.m. charts are sent out at about 10.15 a.m. and the 6 p.m. chart at about 8.30 p.m.

In addition to the charts here referred to, the Patent Type-founding Company are supplied with various diagrams, showing the changes in Pressure, Temperature, Rainfall, Wind, and Weather for the London district. These are engraved *daily* for the "Daily Chronicle," *weekly* for the "Graphic," and *monthly* for the "Miller," and are all accompanied by remarks on the phenomena exhibited.

Charts are drawn for 8 a.m. and 6 p.m. daily for exhibition at the Office, and these, together with special Remarks, and with a copy of the latest Forecasts, are posted at the door.

The draft of the Daily Weather Report, with two charts attached, is ready by noon, when it is at once sent to the lithographer to be printed. The copies for delivery by hand and by early post in London are issued at about 1.30 p.m., while the remainder are received at the Meteorological Office at about 3.30 p.m. whence they are transmitted by post to the subscribers and others.

The 2 p.m. observations, taken at fifteen home and two foreign stations (Skudesnaes and Rochefort) are received at about 3 o'clock. Copies of these are issued, together with the 8 a.m. report, to certain newspapers and subscribers, and two copies of the "Remarks" (8 a.m. and 2 p.m.) are sent to the Type-founding Company for issue to provincial newspapers, in order to explain the charts mentioned above.

The evening (6 p.m.) reports arrive between about 6.30 and 7.30 p.m., and are charted and discussed for the morning daily papers in accordance with the arrangement referred to on p. 10. The forecasts and remarks are usually ready by 8.30 p.m., but in bad weather, owing to the delay of the reports, and the additional care which is necessary in dealing with them, it is occasionally 9 p.m. before they are issued. The "Times" publishes in its First Edition the map showing the distribution of pressure, the winds, temperature, and weather at 6 p.m. on the previous day, and in its Second Edition a similar map for 8 a.m. on the day of issue.

The official charts for 2 p.m. and for 6 p.m. are still much less complete than that for 8 a.m., notwithstanding the great improvements recently made. That for 2 p.m. is drawn on the information received from fifteen home stations, supplemented by two foreign ones, whenever the latter arrive in time to be used. The material for the 6 p.m. charts is supplied by reports from twenty stations in the United Kingdom, supplemented by nine from continental stations. The latter arrive now more promptly than formerly.

The Sunday duty is still conducted as follows:—Two of the clerks attend on Sunday mornings at the Central Telegraph Station from 8.30 a.m. to about 10.15 a.m. By an arrangement with the Post Office these clerks are supplied with the telegrams immediately they arrive in London. These are examined and charted, with the view of issuing, when necessary, warnings of coming storms, to our own and neighbouring coasts. It is necessary that great promptitude should be observed in this service, as the observations must be dealt with and the warnings issued so that the latter may reach the coast before the telegraph offices at the outports close for the day, which is in many cases at about 10 a.m. No work of any kind is transacted for the newspapers on Sunday mornings, the main object of the service being to give early information of storms to our coasts; but a telegram is sent to Jersey in the same form as on week days, and there is the ordinary interchange of messages with foreign countries. A copy of the Valencia message is sent to Lisbon as on week days. At 6 p.m. the same clerks attend at the Meteorological Office to receive the evening telegrams and to prepare the 8.30 p.m. Forecasts.

Atlantic Telegrams.

In the course of the year the arrangements for receiving messages from the United States through M. Mascart, the Director of the French Meteorological Bureau, have been continued, but it has been deemed advisable to allow the plotting of the observations to remain in abeyance as the value of such information, in its present form, is far from being established.

Daily Weather Report.

No important change has been made during the past year in the *form* of the Daily Weather Report, a detailed description of which is given in the Annual Report for 1887. The Report still fills four large quarto pages, and contains the whole of the 59 reports from which the maps for the day (given on page 2) are prepared, and the 6 p.m. reports of the previous day, together with the maximum and minimum temperatures of the air, and the Rainfall for the previous 24 hours.

Two maps are added, showing (1) for 8 a.m. the distribution of pressure, the prevalent winds, and the sea disturbance, with necessary explanations; (2) the distribution of temperature at 8 a.m., the weather

at each station, and the distribution of rainfall during the past 24 hours. Tables are added giving the means of pressure, temperature, and rainfall as heretofore.

Page 3 contains (1) notes on the "General situation at 8 a.m.," and the "Probable changes in system now prevalent;" and (2) the forecasts drawn up for each district at 11 a.m., relating to the weather likely to be experienced during the 24 hours ending at noon on the day succeeding that of publication, and an explanation of the meaning of the storm signals exhibited on our coasts.

The standing portion of the report (maps, &c.) is printed in blue, while the information for each day is in black.

The lithographed Reports have the Forecasts issued at 11h. a.m. incorporated with them on each week day. The subscription for the Report is—

For delivery by hand, where feasible, £2 per annum;
Do. by book post £1 „

MS. copies of the observations and Remarks can be supplied at the rate of 2*l.* 10*s.* per annum. Arrangements can also be made for the supply of charts drawn from the 8h. a.m. or 6h. p.m. observations, such as appear in the "Times."

Correction and Addition List.

Additional steps are taken to insure accuracy in the Daily Weather Report. At the close of each month a return is received from nearly all of the telegraphic reporting stations, containing a copy of all the observations which have been transmitted to London by wire during the month. These schedules are used for checking the daily telegrams, for the preparation of the average and other values of the different elements, and also as evidence in the case of legal proceedings. About the middle of every month a lithographed sheet has for many years past been issued with the Daily Weather Report, containing corrections for all discrepancies which have been discovered, and supplying any observations which have been omitted in the daily reports. The monthly tables showing, for each telegraphic reporting station within our Islands, the mean values for pressure, temperature, and humidity, together with the total rainfall, and the prevalence of various kinds of weather and of winds from each of the eight principal points during the month are now issued in another form.

Weekly Weather Report.

The Weekly Weather Report, which has appeared since the beginning of February 1878, has now been improved by the addition of a monthly supplement giving for each of the stations included in the Daily and Weekly Weather Reports, the principal meteorological features, for all the elements, observed during the month, illustrated by four small maps and a brief summary of the features exhibited.

In the Weekly Report the Summary on the first page contains the average and extreme temperatures, the rainfall values, and the total amount of bright sunshine in each week, for twelve districts in Great Britain, Ireland and the Channel Islands, together with the difference between them and the respective mean values for the corresponding week in previous years. The district values for Accumulated Temperature, Rainfall, and Bright Sunshine are also given, both for the week and for the whole period since the beginning of the year, with their difference from the average values. This information is derived from observations

made at 77 stations, the individual values for which are given on the last page of the Report.

The tables of Accumulated Temperature are designed to give persons engaged in agriculture better means of estimating the manner in which vegetation is affected by temperature than that afforded by the more usual methods of treating the readings of the thermometer. They show for each week, and for the whole period from the beginning of the year, the weekly and progressive values respectively, of the combined amount and duration of the excess or defect of the air temperature, above or below a suitably fixed standard or *base temperature*. The base adopted is 42° F., as being nearly equivalent to 6° Cent. which has been considered by Continental writers on these subjects to be the critical value, the temperature above which is mainly effectual in starting and maintaining the growth, and in completing the ripening of agricultural crops in a European climate. This base is also convenient as being 10° F. above the Freezing Point.

Accumulated Temperature is expressed in Day-degrees; a Day degree signifying 1° F. of excess or defect of temperature above or below 42° F. continued for 24 hours, or any other number of degrees for an inversely proportional number of hours.

An explanation of these rules will be found in the last Annual Report, and full details as to the facts on which the rules are founded are published in Appendix II. to the Quarterly Weather Report for 1878.

The temperature means, derived from the daily maxima and minima, are corrected so as to agree as closely as possible with the true mean daily value, and, the average values for the corresponding period in former years having been recomputed, those now in use are:—

For Temperature	- -	20 years 1861–80
„ Rainfall	- -	20 „ 1866–85

These statistics are given on the first page of the publication, the temperature, accumulated heat, rainfall, and sunshine values for *each station** being given on the last page of each report.

In addition to the telegraphic reports, and the returns from the self-recording observatories, weekly returns from 43 volunteer observers are used, the names of the observers at each station being as under—

Names of Stations.	Names of Authorities.
Alnwick Castle - - -	Lieut.-Col. F. Holland, for the Duke of Northumberland, K.G.
Arlington (N. Devon) - -	J. Carter, for Lady Chichester.
Bawtry (Hesley Hall) - -	B. I. Whitaker, F.R. Met. Soc.
Blackpool - - -	J. Wolstenholme, F.R. Met. Soc.
Braemar - - -	J. A. Aitken.
Brookeborough - - -	Mr. Ferguson, for Sir Victor Brooke, Bt., F.L.S.
Cheadle - - -	J. C. Philips.
Churchstoke - - -	P. Wright, F.C.S., F.R. Met. Soc.
Cirencester - - -	The Royal Agricultural College.
Cullompton - - -	T. Turner, J.P., F.R. Met. Soc.
Douglas (Isle of Man) - -	A. W. Moore, M.A., J.P.
Dublin - - - -	J. W. Moore, M.D., F.R. Met. Soc.
Durham Observatory - -	H. J. Carpenter.

* The sunshine values are furnished for only a limited number of carefully selected stations. See p. 69.

Names of Stations.	Names of Authorities.
Edgeworthstown (Currygrane) -	J. M. Wilson, D.L., J.P.
Fort Augustus - - ♆	Rev. W. M. Wall.
Foynes - - - -	W. Ward, for Lord Monteagle, K.P.
Geldeston - - - -	E. T. Dowson, F.R. Met. Soc.
Glen Carron - - ♆	D. D. Munro.
Glenlee - - - ♆	G. Maxwell and W. Melville.
Hastings (St. Leonard's) - -	H. Colborne, M.R.C.S.
Hereford - - - ♃	T. A. Chapman, M.D.
Hillington - - - ♃	Rev. H. E. B. Ffolkes, M.A., F.R. Met. Soc.
Ingatestone - - - -	L. J. Petre, F.R. Met. Soc.
Kilkenny - - - -	H. Carlton, for the Marquis of Ormonde.
Killarney - - - -	The Ven. Archdeacon Wynne, F.R. Met. Soc.
Lairg - - - ♆	W. Ross, Ground Officer.
Landale (Loch Sunart) - -	A. Fletcher, for T. H. G. Newton, F.R. Met. Soc.
Llandovery - - - -	J. Watkins, F.R. Met. Soc.
Llandudno - - - ♃	J. Nicol, M.D., F.R. Met. Soc.
Londonderry - - -	J. Conroy, F.R. Met. Soc.
Marchmont - - - ♆	P. Loney.
Markree Castle (Sligo) - -	A. Marth, F.R.A.S., for Colonel Cooper, F.R.A.S.
Newton Reigny (Penrith) - -	T. G. Benn, F.R. Met. Soc.
Ochtertyre - - - ♆	G. Croucher.
Plymouth - - - -	J. Merrifield, LL.D., F.R.A.S.
Prestwich (Manchester) - -	T. R. H. Clunn, M.D., F.R. Met. Soc.
Rothamsted - - -	Rainfall by Sir J. B. Lawes, Bart., LL.D., F.R.S., and J. H. Gilbert, Ph.D., F.R.S.; temperature by T. Wilson, F.R. Met. Soc.
Scarborough - - - ♃	W. Robinson.
Southampton - - -	J. T. Cook, R.E., Ordnance Survey Office.
Stowell - - - ♃	Rev. H. J. Poole, F.R. Met. Soc.
Strathfield Turgiss - - ♃	Rev. C. H. Griffith.
Thurcaston (sunshine only) - -	Rev. T. A. Preston.
Waterford (Brook Lodge) - -	C. Percival Bolton, J.P.

The returns for Stations marked "♃" are supplied through the Royal Meteorological Society those marked "♆" are through the Scottish Meteorological Society.

The report is prepared on Wednesday in every week, and is ready for sale early on Saturday morning, but the summary on its first page is sent to the "Times," "Daily News," and several other papers on Wednesday evening.

Appendices.

Appendices, four in number, have appeared similar to those for last year, and a Monthly Supplement has been added, as already explained on p. 60. This Supplement is issued in lieu of the Monthly Weather Report issued in former years, and the preparation of which it was found impossible to maintain.

Monthly Weather Report.

The publication of the *Monthly Weather Report*, so much interrupted by various unavoidable causes, is to be completed till the close of 1887. From that date the instrumental values will appear, with abbreviated notes, as a supplement to the Weekly Weather Report. The numbers

for three months in 1888 and four months in 1889 have already appeared.

Issue of Forecasts.

Remarks on the actual state of the weather, and forecasts *for not more than one day in advance*, are prepared at the Meteorological Office as under:—

On Week Days.

(1.) At 11 a.m. (from the morning reports), for the 24 hours ending at Noon on the day following the date of issue. This issue is intended especially for the early editions of the evening papers, for the clubs, and for exhibition at certain selected stations. See p. 10.

(2.) At 3.30 p.m. (from the morning and afternoon reports), for the day following that of issue. This set of Forecasts is not intended for publication in newspapers, but a copy is exhibited regularly at the door of the Meteorological Office.

(3.) At 8.30 p.m. (from the 8 a.m., 2 p.m., and 6 p.m. reports), for the day following that of issue. These are now supplied gratis to any newspaper or news agency which may apply for them, and send for them regularly. A very large number of the most important papers and news agencies avail themselves of this advantage.

The remarks and forecasts are posted at the doors of the Meteorological Office, 63,* Victoria Street, S.W., on week days,† for the inspection of the public. Copies, or extracts from them, are communicated under the conditions stated below, but no information which is not substantially included in them can be supplied.

Forecasts for Subscribers.—Any person can be supplied with a copy of the 11 a.m. Forecasts, once on each week day,† on payment of a subscription of ten shillings per annum, or 2*s.* 6*d.* per official quarter, *or any part thereof, in addition to the cost of transmission*; the charges will therefore be, by *letter* post, 9*s.*, by *book* post, 5*s.* 9*d.* per quarter.

The forecasts for any of the districts and for any of the hours mentioned above can be forwarded by telegraph daily, on payment of 3*d.* per day for any definite period, in addition to the cost of telegraphy.

Forecasts for Clubs.—These are drawn up at 11 a.m., for all the districts, and are supplied to Clubs, for a subscription of ten shillings per annum. They are delivered free, by hand, to Clubs situated in or near Pall Mall. Special arrangements can be made for delivery at a greater distance by hand or by post.

Forecasts for Hay and Corn Harvests, or for Public Use.—Special facilities are offered for the transmission of Forecasts for these purposes, a nominal fee of 2*s.* 6*d.* being charged for a quarter or any part thereof, in addition to the cost of the telegrams.

Exhibition of Telegraphic Forecasts at Local Post Offices.—The Post Office has sanctioned the exhibition of Forecasts at Local

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* Victoria Street has been re-numbered, so that the address of the Meteorological Office is now "63, Victoria Street, S.W."

† Good Friday and Christmas Day are reckoned as Sundays.

Post Offices, provided space is available, if the persons to whom they are addressed desire them to be so exhibited instead of being delivered.

Unless otherwise arranged, all forecasts transmitted by post are sent by book post, not as letters.

Inquiries as to the Weather.

Inquiries Personally or by Messenger.—Any person applying at the Meteorological Office between 11 a.m. and 8 p.m. on week days, and between 7 p.m. and 8 p.m. on Sundays, can be supplied, in writing, with the latest information in the possession of the Office and with the latest forecast issued for any specified district, on payment of one shilling for each inquiry.

Inquiries by Letter.—Application may be made by letter, enclosing thirteen pence in stamps if the reply is to be *by post*, and one shilling in stamps, in addition to the cost of the reply (consisting of ten words, exclusive of the address) if the reply is to be *by telegraph*.

Inquiries by Telegraph.—Any person may obtain *by telegraph* from the Meteorological Office the latest information as to the weather in any district of the United Kingdom by payment of a fee of 1*s*. in addition to the cost of a telegram and reply to any post office. The telegram containing the inquiry must be addressed as follows:

Weather,
London.

The payment for the reply should be for at least ten words in addition to the address.

Application may also be made for similar information to be sent either *by telegraph* or *post* on some future specified day.

Checking of Forecasts.

In order to test the accuracy of the forecasts they are compared carefully with the weather reported in the various districts on the days to which they referred, and the results of the checking for 8.30 p.m. are given in this Report (p. 10).

In carrying out this comparison the portions of the forecasts which referred to wind have been carefully separated from those relating to weather. The detailed results of the comparison will be found in Appendix X., p. 68.

Checking of Storm Warnings.

The testing of the warnings is conducted in the following manner. The intelligence issued is compared with the weather experienced on the coasts, as indicated by the various self-recording anemometers, by the telegraphic reporters, and by several gentlemen who have volunteered to observe for the Office, and whose names will be found in Appendix XIII., p. 75.

In order to render the information in the possession of the Office as to the weather experienced on our coasts still more complete, the Council

have, as in preceding years, made application to the various Lighthouse Boards, and have obtained from them the original log-books from some of the most exposed lightships and lighthouses. They would here express their cordial thanks for the co-operation so readily granted to them by these Boards.

The result of the checking for 1888 will be found on p. 14.

The coasts are subdivided into ten districts, as will be seen in the table. Two large tracts of coast are entirely omitted: viz., the west of Ireland from the Shannon to Malin Head, and the West of Scotland from the Mull of Cantyre to Cape Wrath. No warnings are issued to any place within the limits indicated, except to Galway, and the amount of information as to the weather received from the omitted portion of the Scotch coast is, as yet, very scanty.

It should be remembered that in analysing the reports, all observations of the wind in which the force *exceeded* 7 (a "moderate gale") or the velocity exceeded 40 miles an hour, have been quoted as instances of the occurrence of a gale; but it has not been considered that the signal was hoisted late or was hauled down too soon, unless the force of 9 (a "strong gale") or the velocity of 50 miles an hour, was reached prior to the issue of the order to hoist, or subsequent to the issue of the order to lower.

In the Summaries all cases in which the signal has been shown to be late by a single report either of force 9, or of a velocity of 50 miles an hour, have been specially noted.

APPENDIX VIII.

Fishery Barometers.

List of Places supplied with Fishery Barometers.

Shetland Isles.—*Balta Sound, *Uya Sound, *Nesting, *Lerwick, *Sandsair, *Scalloway, *Symbister.

Orkney Isles.—*Burra, *Kirkwall.

Scotland, east coast.—*Stroma, *Keiss, *Staxigoe, *Wick, *Sarclet, *Lybster, *Dunbeath, *Portmahomack, *Cromarty, *Avoch, *Nairn, *Burghead, *Portessie, *Port Knockie, *Portsoy, *Whitehills, *Gardenstown, *Rosehearty, *Pitullie, *Inverallochy, *Pointlaw, *Findon, *Portlethen, *Skateraw, *Stonehaven, *Arbroath, *Broughty Ferry, *St. Andrews, *Crail, *Cellardyke, *St. Monance, *Burntisland, *Newhaven.

England, east coast.—*Berwick, *North Shields, *South Shields, *Sunderland, *West Hartlepool, *Staithes, *Scarborough, *Filey, *Flamborough, *Bridlington Quay, Withernsea, Hull, *Lynn (2), *Wells, *Gorleston, *Harwich, *Brightlingsea, *Margate, *Deal, *Kingsdown, *Dover (2).

England, south coast.—Bognor, Ryde, East Cowes, Bembridge, Brixton, Atherfield, Ventnor (2), Gorey (Jersey), Haslar Hospital,

* Inspected.

Poole, Weymouth, Portland, Budleigh Salterton, Exmouth, Cawsand, Mevagissey, Gorranhaven, Devoran, Portscatha, Penryn, Durgan, Porthallow, Falmouth, Coverack, Newlyn, Mousehole.

England, south-west coast.—St. Ives, Hayle, Padstow, Port Isaac, Boscastle, Highbridge, Weston-super-Mare.

Wales.—Briton Ferry, Swansea, *Angle, *Milford, Carnarvon.

England, north-west coast.—*Fleetwood, *Morecambe, *Maryport.

Isle of Man.—Douglas, *Port St. Mary, *Peel.

Scotland, south-west coast.—*Port Patrick, *Stranraer.

Ireland, east coast.—*Cushendall, *Belfast, *Bangor, *Groomsport, *Donaghadee, *Ardglass, *Carlingford, *Greenore, *Dundalk, *Malahide, *Howth, *Kingstown (2), *Bray, *Wicklow.

Ireland, south coast.—Dunmore, Dungarvan, Crosshaven, Kinsale, Union Hall, Castletownsend, Baltimore, Schull, Crookhaven.

Ireland, west coast.—*Valencia, Dingle, Tralee, Tarbert, Kilcredane, Kilronan, Spiddal, *Elly Bay, *Ballyglass, *Ballycastle (Co. Mayo), *Donegal, *Tribane, *Killybegs, *Teelin, *Portnoo, *Burton Port, *Kincaslagh, *Bunbeg.

Ireland, north coast.—*Dunfanaghy, *Rathmullen, *Buncrana, *Moville, *Portrush, *Portstewart.

Scotland, west coast.—*Tarbert, *Campbeltown, *Carradale, *Portree (Isle of Skye), *Plockton.

Hebrides.—*Stornoway, *Cromore, *Obb, *Ness.

SUMMARY of STATIONS supplied with INSTRUMENTS.

England and Wales - - - - -	65
Scotland and Isle of Man - - - -	56
Ireland - - - - - -	48
	169

APPENDIX IX.

TELEGRAPHIC WEATHER INTELLIGENCE.

The following stations are supplied with telegraphic information of storms, free of expense, and signal "cones" have been furnished to most of them, all further expenses attendant on the maintenance and repair of the apparatus being borne locally. The stations are situated,

* Inspected.

84 in England and Wales, 41 in Scotland, 15 in Ireland, 3 in the Isle of Man, and 3 in the Channel Islands.

NORTH.	WEST.	SOUTH.	EAST.
SCOTLAND, EAST COAST.	ENGLAND, N.W.	ENGLAND, S.W.	ENGLAND, E.
Dunrossness.	Ramsey.	Ilfracombe.	Eyemouth.
Lerwick.	Douglas.	Appledore.	Berwick-on-Tweed.
Scalloway.	Castletown.	Boscastle.	Tynemouth.
Stromness.	Silloth.	Port Isaac.	S. Shields.
Kirkwall.	Maryport.	Newquay.	Sunderland.
Holborn Head.	Workington.	Hayle.	Middlesborough.
Wick.	Whitehaven.	Scilly.	Redcar.
Inverness.	Barrow.	St. Sennen.	Whitby.
Nairn.	Morecambe.	St. Just.	Filey.
Burghead.	Fleetwood.	Penzance.	Bridlington Quay.
Lossiemouth.	Blackpool.	Falmouth.	Hull.
Buckie.	Lytham.	Pendennis.	Goole.
Port Knockie.	Southport.	Mevagissey.	Grimsby.
Portsoy.	Runcorn.	Plymouth.	Boston.
Banff.	Liverpool.	Teignmouth.	Sutton Bridge.
Cullen.	Connah's Quay.	Exmouth.	Lynn.
Fraserburgh.	Port Penrhyn.		Sheringham.
Peterhead.	Holyhead.		Cromer.
Aberdeen.	Port Dinorwic.		
Stonehaven.	Carnarvon.		
Montrose.	ENGLAND, W.		
Broughty Ferry.	Aberystwith.	ENGLAND, S.	ENGLAND, S.E.
St. Andrews.	Milford.	Guernsey.	Yarmouth.
Dundee.	Pembrey.	St. Helier's (Jersey).	Southwold.
Bo'ness.	Llanelly.	Gorey (Jersey).	Ipswich.
Grangemouth.	Swansea.	Weymouth.	Harwich.
Anstruther.	Briton Ferry.	Poole.	Chatham.
Pittenweem.	Porthcawl.	Cowes.	Sheerness.
Burntisland.	Penarth.	Ryde.	Faversham.
Granton.	Cardiff.	Portsmouth.	
Newhaven.	Newport.	Littlehampton.	
Leith.	Weston-super-Mare.	Brighton.	
Fisherrow.	Burnham.	Newhaven.	
Dunbar.		Hastings.	
Cockburnspath.	IRELAND, E.	Rye.	
	Belfast.	Sandgate.	
	Donaghadee.	Folkestone.	
	Howth.	Dover.	
FIRTH OF CLYDE.	Kingstown.	Margate.	
Glasgow.	IRELAND, S. and W.		
Greenock.	New Ross.		
Rothesay.	Dunmore East.		
Campbelton.	Dungarvan.		
Girvan.	Youghal.		
Ballantrae.	Queenstown.		
	Passage.		
	Kinsale.		
	Cork.		
	Tralee.		
	Limerick.		
	Galway.		

The signals used consist of:—

1. Cone, point downwards for Southerly gales; S.E. round by S. to N.W.
2. Cone, point upwards for Northerly gales; N.W. round by N. to S.E.

The signals are to be kept hoisted *during the daylight only*, until 48 hours have elapsed from the time *the telegram was despatched*, unless countermanded. At night, lanterns may be used wherever the local authorities deem it desirable to do so.

The meaning of the signals is that an atmospherical disturbance exists (which will be explained in the telegram), and will probably, but not *necessarily*, cause a gale at the place warned, *from the direction* indicated by the signal.

The Meteorological Office supplies the canvas shapes and lanterns to such places as require them, on loan, but in all cases the local authorities must undertake the charges incidental to the hoisting of the signal, such as flagstaff and gear, oil, &c., and also to the keeping of the apparatus in repair, painting, &c.

APPENDIX X.

REPORT ON THE COMPARISON OF THE FORECASTS ISSUED AT 8h. 30m. p.m. WITH THE WEATHER SUBSEQUENTLY EXPERIENCED, for the 12 Months, April 1888 to March 1889. The results are for the United Kingdom as a whole.

The letters used have the following signification:—

a = complete success.	c = partial failure.
b = partial (more than half) success.	d = total failure.

The checking has been conducted on the same system as that employed in previous years, *i. e.*, each forecast has been considered under the separate headings of "Wind" and "Weather," but the results of the 8.30 p.m. Forecasts only are here published.

The first column gives the percentage of success in "Wind," the second in "Weather," and the third the average of the two.

The Summary for the whole year is given at page 10.

Months.		Percentages.				Months.		Percentages.			
		Wind.	Weather.	Average.	a + b.			Wind.	Weather.	Average.	a + b.
April	a	49	47	48	84	October	a	55	56	56	84
	b	37	34	36			b	28	29	28	
	c	11	12	11			c	11	10	11	
	d	3	7	5			d	6	5	5	
May	a	49	57	53	83	November	a	41	55	48	82
	b	34	26	30			b	36	31	34	
	c	12	6	9			c	16	7	11	
	d	5	11	8			d	7	7	7	
June	a	56	49	53	80	December	a	38	50	44	75
	b	28	27	27			b	31	31	31	
	c	8	14	11			c	21	12	17	
	d	8	10	9			d	10	7	8	
July	a	48	55	52	82	January	a	50	45	47	80
	b	33	28	30			b	29	37	33	
	c	12	12	12			c	10	14	12	
	d	7	5	6			d	11	5	8	
August	a	51	45	48	85	February	a	38	60	49	86
	b	39	35	37			b	44	29	37	
	c	6	13	10			c	13	6	9	
	d	4	7	5			d	5	5	5	
September	a	45	59	52	84	March	a	43	52	48	83
	b	38	26	32			b	37	34	35	
	c	13	8	11			c	15	6	11	
	d	4	7	5			d	5	8	6	

APPENDIX XI.

LIST of STATIONS from which CONTINUOUS RECORDS of BRIGHT SUNSHINE have been received.

Station.	Observer.
Aberdeen - - - -	Prof. C. Niven, M.A., F.R.S.
Armagh - - - - -	J. L. E. Dreyer, Ph.D., F.R.A.S.
Blackpool - - - -	J. Wolstenholme, F.R. Met. Soc.
Cambridge - - - -	H. Todd.
Churchstoke - - - -	P. Wright, F.C.S., F.R. Met. Soc.
Cirencester - - - -	Prof. Ohm, B.A., F.R. Met. Soc.
Cronkbourne, Isle of Man - -	A. W. Moore, M.A., J.P.
Cullompton - - - -	Thos. Turner, J.P., F.R. Met. Soc.

Station.	Observer.
Dublin	Lt. Col. A. B. Coddington, R.E., and subsequently Major Kirkwood, R.E.
Durham	H. J. Carpenter.
Eastbourne	R. Sheward, F.R. Met. Soc.
Falmouth	E. Kitto, F.R. Met. Soc.; for the R. Cornwall Polytechnic Soc.
Geldeston, Beccles	E. T. Dowson, F.R. Met. Soc.
Glasgow	Prof. R. Grant, M.A., LL.D., F.R.S.
Hastings	H. Colborne, M.R.C.S.
Hillington	Rev. H. E. B. Ffolkes, M.A., F.R. Met. Soc.
Jersey (St. Aubin's)	J. Fisher.
Kew Observatory	G. M. Whipple, B.Sc., F.R.A.S.; for the Kew Committee.
Leicester (Thurcaston)	Rev. T. A. Preston, M.A., F.R. Met. Soc.
Llandudno	J. Nicol, M.D., J.P., F.R. Met. Soc.
London, Bunhill Row	Messrs. de la Rue.
" Westminster	The Staff, Meteorological Office.
Marchmont	P. Loney.
Markree Castle	A. Marth, F.R.A.S.; for Col. E. H. Cooper, F.R.A.S.
Newton Reigny (Penrith)	T. G. Benn, F.R. Met. Soc.
Oswald Kirk, Yorkshire	R. Thompson.
Oxford	E. J. Stone, F.R.S.
Parsonstown	O. Boeddicker, Ph.D.; for the Earl of Rosse, F.R.S.
Plymouth	J. Merrifield, LL.D., F.R.A.S.
St. Ann's Head	S. Blake.
Southampton	Sir C. Wilson, Col. R.E., K.C.B., F.R.S.
Stonyhurst	Rev. S. J. Perry, M.A., F.R.S.
Stornoway	John Forbes.
Sutton Coldfield	J. Fletcher, C.E.
Swanbister (Orkney)	W. Irvine Fortescue.
Valencia	J. E. Cullum.
Worksop	H. Mellish, F.R. Met. Soc.
York	J. E. Clarke, B.A., B.Sc.

In addition, the number of hours sunshine recorded each day is reported from the following Stations:—

Glencarron	D. D. Munro.
Braemar	J. A. Aitken.
Stowell	Rev. H. J. Poole, F.R. Met. Soc.

APPENDIX XII.

Methods followed in dealing with Meteorological Returns from Land Stations in the British Isles.

These stations are of five classes, as stated on page 17.

I.—*Observatories continuously observing all the Meteorological Elements.*

Returns from observatories.

Hourly measurements of the curves obtained from the self-recording instruments at the observatories of the Office are made by the observers at each station, on printed forms supplied for the purpose, which, together with the curves, are forwarded to the Office weekly.

They comprise measurements of the barograms, of the dry-bulb and wet-bulb thermograms, of the anemograms, and of the rain-gauge curves.

Examination of returns.

The measurements are subjected to a careful examination in order to ensure as far as possible their accuracy, and the regulations which have been adopted to secure this end are in the main the same as those which will be found in the Report of the Office for 1868. They comprise rules for the guidance of observers, as well as of the assistants charged with the examination of the work at the Office. Attention need be called here to only two of these rules, viz.: (*a*) the use of subsidiary sheets on which are entered the results of a second set of measurements of the curves, made after, and quite independently of, the first set, and with a different scale, the two sets of measurements being afterwards compared together, and any differences found inquired into and set right; and (*b*) the re-measurements of the curve made by the assistants at the Meteorological Office, and which always amount to 40, and in doubtful cases to many more, per month, for each element. The attention of the observers is always drawn to such errors as may be detected, and to any failures in the continuity of the curves arising from failure of the light, stoppage of the clock, defective photography, faulty action of the wet-bulb thermometer, &c.; a report containing the results of the examination of each Observatory being also submitted to the Council periodically. The curves and tabulations are eventually bound and stored in the Office.

Results of examination and report to Council.

General supervision of observatory work.

In connexion with this work should be mentioned the general watch which has to be kept over the working of the observatories and of the instruments, not only to secure uniformity amongst them and observance of rules, but also to guard against small changes which are liable to occur at certain times, especially with the thermographs, and which may affect the scale-values of the instrument or the datum lines used for the tabulation of the curves. About twice a year this work calls for special examination, entailing some considerable time and occasionally the engraving of new scales for measuring the curves.

Harmonic analyser.

The photographic curves are also used in the harmonic analyser; and for this purpose the barograms require a slight special preparation.

Method of dealing with the Numerical Results from the Self-recording Observatories.

Interpolations.

In dealing with the tabulations the first step is to go over the sheets and fill up by interpolation, wherever possible, any gaps or breaks in the continuity of the record.

Means.

The record having been made as complete as possible, the daily, five-daily, and monthly means of the barometer and of the dry-bulb and wet-bulb thermometers are deduced.

Vapour tension.

The hourly vapour tension is then computed by an expansion of Glaisher's Hygrometrical Tables, prepared in the Office, and the work is independently checked.

Hourly Readings.

A copy is next prepared of the above-mentioned hourly measurements of the barometer, dry-bulb and wet-bulb thermometers, wind and rain curves, and of the computed values of vapour tension. To these are added the daily means of the three first-mentioned elements, the extremes and daily range of pressure and temperature, and the daily totals of rainfall, and the whole series is printed and published under the title of "Hourly Readings from the Self-recording Instruments "at the Four Observatories under the Meteorological Council."

To ensure accuracy the sheets are read over in proof with the original measurements of the curves. The interpolated readings are

printed in *italic* type, but no distinguishing mark is affixed to means which are partly based on them. When the gap in the record is too long to be dealt with by an interpolation of the missing hourly readings, the mean for the day is obtained either from the maximum and minimum readings for the day, or by an interpolation from the adjacent daily means, and the result thus obtained is printed as an approximation.

Annual Tables. The five-daily, monthly, and annual means, together with the absolute extremes of pressure and temperature for each month, are printed as part of the "Hourly Readings." The tables are repeated in French measures.

Tables for the Quarterly Weather Reports. Gale tables. The gale tables printed in the text of the Quarterly Weather Report, which show the extent, duration, and degree of severity of all the stronger gales, are prepared from the tabulations of the anemograms received from the self-recording observatories, together with those received from the extra anemographic stations.

II.—*Anemographic Stations at which the Wind is recorded continuously.*

The anemograms received from the stations enumerated on page 75 are regularly examined and tabulated in the Office, and the sheets bound up in volumes. Besides special inquiries on legal and other points that from time to time arise, and in which these documents are of high importance, the tabulations are always employed in the preparation of the summary of weather and gale tables for the Quarterly Weather Report. They are also regularly used in the checking of the Storm Warnings issued by the Office.

III.—*Land Stations of the Second Order.*

Origin and progress of system. Ever since the year 1866 returns of more or less completeness have been received from land stations in the United Kingdom. In that year there was only one station, but by 1871 the number had increased to 15, and five years later to 49, including 14 stations belonging to the Royal Meteorological Society, copies of the returns from which were sent to the Office under a special arrangement with the Society.

At the end of the present year the total number of stations was 77, including 15 belonging to the Royal Meteorological Society and 5 belonging to the Scottish Meteorological Society.

This number is exclusive of the self-recording observatories, and of the anemographic stations, but it includes several from which only very scanty information is received.

The stations are distributed as follows: 42 in England, 3 in Wales, 12 in Scotland, and 20 in Ireland.

The returns are received at the Office monthly, and are duly entered and stored.

Publication on Form A. The publication of the returns is carried out in the following way: For a certain number of stations the observations of pressure (to the second place of decimals), temperature, wind, cloud amount, and weather, at 9 a.m. and 9 p.m. each day, together with the computed vapour tension and relative humidity at those hours, and the daily maxima and minima of temperature, and daily rainfall, are published *in extenso* on the Form A., proposed by the Permanent Committee of the First International Meteorological Congress at Vienna in 1874, and adopted for international use by the Second International Meteorological Congress at Rome in 1879,

The Permanent Committee assigned an inferior limit to the number of stations from which returns should be published *in extenso*, varying from 2 for Belgium to 100 for Russia in Asia, the number in the case of the United Kingdom being 15. In 1875, when the systematic publication of returns from Stations of the Second Order began, the results from only nine stations in connexion with the Office were available, but this number has steadily grown, until for 1880 returns from 33 stations were published on the A. Form. The volume for 1885, which is now completed, contains returns from 32 stations.

Additions to the list for publication.

Care is taken in adding to the list for publication to see, first, that the station is satisfactory as regards its instruments, their exposure, &c.; secondly, that the returns bear internal evidence of accuracy and care in their preparation; and thirdly, that the district represented by the station is one for which information is needed.

Examination.

Full particulars as to the methods adopted in the examination of the returns will be found in previous reports.

Publication on Form B.

Besides this publication in full, the monthly means of the various elements, together with summaries of the wind direction and of the weather, are published on the Form B., also devised by the Permanent Committee of the Vienna Congress, and adopted by the Roman Congress.

Returns from six stations were published in this manner for the year 1873, and from nine stations for the year 1874. In 1875 the list included the names of 26 stations. This number has grown to 46 for the year 1885, and might be even further increased.

All the stations, returns from which are published *in extenso* on Form A., are included in the Form B. list. But this list also includes others, either not quite so good, not so representative, or not so long established. The method of preparation is in the main the same as in the case of the Form A. But the summaries of wind and weather for all the stations are specially prepared for this publication. For wind, the summary shows the number of *observations* at 9 a.m. and 9 p.m. under each of the semi-quadrantal points N., N.E., E., &c., the observations under intermediate points being thrown alternately forward and backward. For weather, the summary gives the number of *days* of rain, snow, hail, thunderstorm, clear sky, overcast, and gale. The days of clear sky and overcast are those when the means of the cloud-amounts at 9 a.m. and 9 p.m. are less than 2, and more than 8 respectively. The days of gale are those when force 7 or upwards, by Beaufort scale, is recorded.

British rainfall.

The monthly rainfall values (total, number of rainy days, and maximum) for the observatories and all the Stations of the Second Order are supplied each year to Mr. Symons, F.R.S., for publication in his "British Rainfall."

Unpunctual observations.

The observations are taken at 9 a.m. and 9 p.m. local time each day. It sometimes happens, however, that strict punctuality cannot be observed. In such cases, if the difference in time does not exceed 30 minutes, the observations are, in most cases, printed without alteration. When the difference exceeds 15 minutes, a note is inserted in the remarks showing the exact time of observation. If the difference in time is more than half-an-hour, the readings are usually rejected and an interpolation made.

New stations.

When an application for the adoption of a new station is received, a schedule is forwarded to the observer containing a series of questions as to the outfit of the station, the exposure of the instruments, and the influence likely to be exerted on their indications by surrounding objects, such as houses and trees. Only mercurial barometers are accepted, and only such as have been duly verified. All thermometers must have been tested at Kew. A plan of the station, showing the positions of the instruments with regard to neighbouring objects is also required.

On the return of this schedule the answers are considered, and, where necessary, alterations are advised.

If, however, the existing arrangements are satisfactory, tables for reducing the barometer readings to 32° Fahrenheit at mean sea level are prepared and duplicates sent to the observer, together with a set of Hygrometrical Tables, and a copy of "Instructions in the Use of Meteorological Instruments."

The first returns are compared and examined with special care, and a report of the result of the examination is forwarded to the observer, with instructions how best to complete and perfect the returns.

Sunshine records.

The daily records of sunshine which are now received from 36 Stations in the British Islands are examined generally to guard against accidental changes in the adjustment of the instruments. Notes explaining any omission or accidental defect are added to the cards if required, and after their receipt has been acknowledged, they are duly stamped and dated and then stored in the Office.

Weekly totals.

A tabulation of these curves is published as part of the Weekly Weather Report, mentioned in Appendix VII., and for those stations which are also Stations of the Second Order the monthly totals of bright sunshine in hours, together with the percentage of its possible duration, is published as Part IV. of "Returns from Stations of the Second Order." A table showing the daily amount of sunshine at Bunhill Row, one of the London stations, is also prepared quarterly for the Royal Meteorological Society.

Inspection.

The Stations of the Second Order are regularly inspected, the attention of the inspector being directed by the Office to any special point which may require investigation.

IV.—*Telegraphic Reporting Stations.*

Full particulars relating to these stations, the information received from them, and the method of dealing with that information, will be found in Appendix VII. A paragraph in that Appendix (p. 60) explains the use that is made of the monthly schedules sent in by the observers.

V.—*Extra Stations.*

No returns from Stations of the Fifth Class are published by the Office, but some of them are regularly used in the checking of the Storm-Warnings, and all are available for any special investigation that may be taken up.

The rainfall values at these stations are, however, copied and supplied to Mr. Symons, F.R.S., for publication in "British Rainfall."

APPENDIX XIII.

LIST OF DOCUMENTS RELATING TO THE LAND METEOROLOGY OF THE BRITISH ISLANDS, RECEIVED DURING THE YEAR ENDING MARCH 31ST, 1889.

Stations.	Observers.	Nature of Information received.	Notes.
I. †Valencia	J. E. Cullum	Continuous records of pressure, temperature, wind, sunshine, and rain, with eye observations of the clouds and notes on the weather.	
†Glasgow	Prof. R. Grant, M.A., LL.D., F.R.S.		
†Aberdeen	Prof. C. Niven, M.A., F.R.S.		
†Falmouth	E. Kitto, F.R. Met. Soc.		
†Stonyhurst	Rev. S. J. Perry, S.J., F.R.S.		
†Kew	G. M. Whipple, B.Sc., F.R.A.S., F.R. Met. Soc.		
II. †Armagh	J. L. E. Dreyer, Ph.D., F.R.A.S.	Continuous record of wind, rainfall, and sunshine.	
Alnwick Castle	Lt.-Col. F. Holland, for the Duke of Northumberland, K.G.	Continuous record of wind (direction and velocity).	
†Dublin (Phœnix Park)	The late Lt.-Col. A. B. Coddington, R.E., and Major Kirkwood, R.E.	,, ,,	
†Fleetwood	M. S. Gaulter, C.E.	,, ,,	
†Holyhead	Hugh Williams, C.E.	,, ,,	
†North Shields	Capt. W. Harrison	,, ,,	
†Swanbister (Orkney)	W. I. Fortescue, Esq.	,, ,,	
Scilly	W. Thomas	,, ,,	
†Yarmouth	G. T. Watson	,, ,,	
Heligoland	J. J. Friederichs	,, ,,	
†Kilkenny Castle	The Marquis of Ormonde	Continuous record of pressure.	
London	The Athenæum Club	,, ,,	From May 1888.
Nottingham	E. C. Patchett	,, ,,	From July 1888.
Waterford	The Harbour Authorities	,, ,,	
III. †Armagh	J. L. E. Dreyer, Ph.D., F.R.A.S.	Regular observations at 9 a.m. and 9 p.m. of pressure, temperature (dry-bulb and wet-bulb), wind, cloud and weather, with the daily maxima and minima of temperature, the daily rainfall, and general remarks on the weather.	
Aysgarth	Rev. Fenwick W. Stow, M.A., F.R. Met. Soc.		
Babbacombe, Devon	E. E. Glyde, F.R. Met. Soc.		
†Bennington, Herts.	Rev. J. Dunne Parker, LL.D., F.R. Met. Soc.		
Berkhamsted	E. Mawley, F.R. Met. Soc.		
†Braemar	James Aitken, J.P.		

LIST OF DOCUMENTS—*continued.*

Stations.	Observers.	Nature of Information received.	Notes.
†Brookeborough (Colebrooke Park).	W. Ferguson, for Sir Victor Brooke, Bt., F.L.S.	Regular observations at 9 a.m. and 9 p.m. of pressure, temperature (dry-bulb and wet-bulb), wind, cloud and weather, with the daily maxima and minima of temperature, the daily rainfall, and general remarks on the weather.	
Buxton	E. J. Sykes, M.B., F.R.A.S., F.R. Met. Soc.		
Carmarthen	G. J. Hearder, M.D.		
Cheadle	J. C. Philips, Esq.		
Cheltenham	R. Tyrer, B.A., F.R. Met. Soc.		
Churchstoke	Philip Wright, F.C.S., F.R. Met. Soc.		
Cronkbourne, Isle of Man.	A. W. Moore, M.A., J.P.		
Douglas, Isle of Man	Thos. Keig, Esq.		
†Dublin (Botanic Gardens, Glasnevin).	F. W. Moore, M.R.I.A.		
†Dublin (City)	J. W. Moore, M.D., F.R. Met. Soc.		
†Dublin (Mountjoy Observatory).	Sergt. Lipscombe, for Major Kirkwood, R.E., Ordnance Survey Office.		
†Dundee	W. Ross McKelvie, Esq.		
†Dunrobin Castle	D. Melville, for the Duke of Sutherland, K.G.		
Durham	H. J. Carpenter, Esq.		
†Eastbourne	R. Sheward, F.R. Met. Soc.		
†Edgeworthstown	J. M. Wilson, J.P.		
†Epsom (Royal Med. College).	J. S. Jackson, Esq.		
Geldeston (Beccles)	E. T. Dowson, F.R. Met. Soc.		
†Glasgow	Prof. R. Grant, M.A., LL.D., F.R.S.		
Glenalmond	Arthur S. Reid, M.A., F.G.S.		
†Hillington, Norfolk	Rev. H. E. B. Ffolkes, M.A., F.R. Met. Soc.		
†Killarney	The Ven. Archdeacon G. R. Wynne, M.A., F.R. Met. Soc.		
†Laudale (Argyleshire)	A. Fletcher, for T. H. G. Newton, M.A., J.P., F.R. Met. Soc.		
Llandudno	J. Nicol, M.D., J.P., F.R. Met. Soc.		
†Londonderry	J. Conroy, F.R. Met. Soc.		

List of Documents—*continued.*

Stations.	Observers.	Nature of Information received.	Notes.
Margate	J. Stokes, F.R. Met. Soc.	Regular observations at 9 a.m. and 9 p.m. of pressure, temperature (dry-bulb and wet-bulb), wind, cloud and weather, with the daily maxima and minima of temperature, the daily rainfall, and general remarks on the weather.	
Market Rasen	W. B. Jevons		
Markree Castle, Sligo	A. Marth, F.R.A.S., for Col. Cooper, F.R.A.S.		
Newton Reigny (Penrith).	T. G. Benn, F.R. Met. Soc.		
Parsonstown	O. Boeddicker, Ph.D., for the Earl of Rosse, F.R.S.		
Pinmore	Peter Donald		
Prestwich (Manchester)	T. R. H. Clunn, M.D., F.R. Met. Soc.		
Rothesay	James Kay, Esq.		
Rousdon	C. E. Peek, M.A., F.R.A.S., F.R. Met. Soc.		
Scarborough	Allan Rowntree, F.R. Met. Soc.		
Seaham	G. H. Aird		
Southampton	J. T. Cook, R.E., for Director General of the Ordnance Survey.		
Stokesay	Miss M. A. Digges La Touche		
Stonyhurst	Rev. S. J. Perry, S.J., F.R.S.		
St. David's, Pembroke	W. P. Propert, LL.D., F.G.S., F.R. Met. Soc.		
St. Leonards	H. Colborne, M.R.C.S.		
Sutton Coldfield	J. Fletcher, C.E.	- - - - - -	From July 1888.
Swanbister	W. I. Fortescue, Esq.		
Uppingham	Rev. G. H. Mullins, M.A., F.R. Met. Soc.		
Uttoxeter	Rev. R. Barker, F.R. Met. Soc.	- - - - - -	Till December 1888.
Wakefield	H. Clarke, L.R.C.P., F.S.S., F.R. Met. Soc.		
York	J. Wright, for H. M. Platnauer, F.G.S.		
IV. The Telegraphic Stations, see List on page 43		Regular observations twice (and in some cases three times) daily of pressure, temperature, wind, weather, and sea disturbance.	
V. Arlington Court, Devon	J. Carter, for Lady Chichester	Pressure, temperature (dry-bulb, wet-bulb, max., min.), wind and rainfall, once daily.	Till July 1888.
Baltimore	J. Halsey	Pressure, temperature, wind, and weather, once daily.	
Bolton	W. W. Midgley, F.R. Met. Soc.	Full monthly summary	From August 1888.

LIST OF DOCUMENTS—*continued.*

Stations.	Observers.	Nature of Information received.	Notes.
Castletownsend -	Lieut. F. W. Cobb, R.N. - - -	Pressure and temperature four times daily, and wind twice daily.	
Crookhaven - -	" " - - - -		
Chatham (School of Military Engineering).	P. McHugo and D. Harrington, for Instructor in Surveying.	Full return for 9 a.m.	
Cooper's Hill (Egham)	Prof. H. McLeod, F.R.S. - - -	Full return for 9 a.m. and 3 p.m.	
Crosshaven - -	J. W. Bridle - - - - -	Pressure, temperature, and wind, twice daily.	
Cuckfield -	John Howe, Esq. - - - -	Daily rainfall.	
Ennis - -	J. Hill, C.E., F.R. Met. Soc. - - -	Daily rainfall.	
Galway - -	Lieut. E. G. F. Law, R.N. - - -	Pressure and temperature four times daily, with wind.	
Gorleston, Norfolk -	R. J. C. Day - - - - -	Pressure and wind twice daily.	
Harpenden - -	T. Wilson, F.R. Met. Soc. - - -	Pressure, temperature, and wind, twice daily, with rainfall.	
Haslar - -	G. Coppen - - - - -	Pressure and temperature four times daily.	
Knightstown (Valencia).	John Doughty - - - -	Pressure, wind, and weather once daily.	
North Arran - -	Coast Guard - - - - -	Pressure, temperature of air and sea four times daily, with wind and weather at noon.	From September 1888.
Rugby - -	C. H. Hodges, M.A., Geo. M. Seabrooke, F.R.A.S., and W. N. Wilson, M.A.	Full set of 9 a.m. observations with 9 p.m. temperatures.	
Schull - -	Lieut. F. W. Cobb, R.N. - - -	Pressure, temperature, and wind twice daily.	
Sheffield (Weston Park)	Elijah Howarth, F.R.A.S. - - -	Full return for 9 a.m. and 6 p.m.	
†Stamford (Ketton Hall)	Fred. Coventry, Esq. - - - -	Full monthly summary.	
Stranraer - -	P. Doran - - - - -	Pressure, wind, and weather once daily.	
Sudbury - -	W. Bayley Ransom, Esq. - - -	Pressure, temperature (dry-bulb, max., min.), wind, cloud, and rainfall, once daily, with general remarks.	
Symbister, Shetland -	J. S. Nicolson - - - -	Pressure and temperature twice daily.	
Tarbert (Harris) -	Donald Bethune - - - -	Pressure and wind twice daily.	
Union Hall (Glandore)	Lieut. F. W. Cobb, R.N. - - -	Pressure, temperature, and wind, twice daily.	

NOTE.—The Stations marked "𝔐" belong to the Royal Meteorological Society; those marked "𝔖" belong to the Scottish Meteorological Society; those marked thus † have been inspected during the year.

APPENDIX XIV.

ACCESSIONS TO THE LIBRARY DURING THE YEAR ENDING 31ST MARCH 1889.

Abercromby, Hon. R.—Cloud-land in folk-lore and in science. A lecture delivered before the Phil. Inst. Edinburgh, Dec. 6, 1887. 8°. (*Folk-lore Journ.*, vi., *part* 2, 1888, *p.* 94.)

* ——— Instructions for observing clouds on land and sea, with photographs and engravings. 8°. London, 1888.

* **Ackroyd, W.**—Ackroyd's barometer and weather chart. Oblong 8°. Sheet. Leeds, s.a.

Adelaide, Meteorological Society of Australasia.—Minutes of proceedings 1886 and 1887. Vol. ii. la. 8°. Adelaide, 1888.
? Vol. i. is "The history, rules, and regulations, &c."

[Adelaide Observatory.]—Rainfall in South Australia and the Northern territory during 1887 and 1888; with weather characteristics of each month. By **C. Todd.** 2 vols. sm. f°. Adelaide, 1888–89.

|| **Agamennone, G.**—Il terremoto nel vallo Cosentino del 3 Dicembre 1887. sm. f°. Roma, 1888. (*Annal. Ufficio Centr. Meteor. e Godinam.*, viii., 1886, *parte* iv.)

Airy, [G. B.]—Table of altitude. Corresponding numbers of elevation in English feet, and of readings of aneroid or corrected barometer in English inches; (the meau of atmospheric temperatures being 50° Fahrenheit). 4°. Sheet.

|| **Aitken, J.**—On the number of dust particles in the atmosphere. la. 4°. Edinburgh, 1888. (*Trans. R. Soc. Edinb.*, xxxv., *part* i.)

[Allahabad, Meteorological Office.]—Brief sketch of the meteorology of the North-west Provinces, Oudh, and Eastern Rajputana for the year 1887. sm. f°. s.l.e.a.

Allahabad, Meteorological Reporter to Government, North-west Provinces and Oudh.—Administrative report . . . for the year 1887–88. sm. f°. s.l.e.a.

Algiers, Service Météorologique [du Gouvernement Général] de l'Algérie.—Bulletin mensuel. 1887, Jan.—Dec. Nos. 26–37. sm. f°. s.l.e.a.

[——— ———] Bulletin météorologique de l'Algérie. 1888, Jan. 1—Dec. 31. Oblong sm. f°. Sheets.

|| ——— ——— Observations météorologiques du réseau africain. Années, 1884–85. 2 vols. la. 4°. Paris, 1887–88. (*Ann. Bureau central météor.*, 1884–85, II.)

American Meteorological Journal.—A monthly review of meteorology, medical climatology, and geography. Edited by **M. W. Harrington** and **A. L. Rotch.** Vol. III., May, 1887—April, 1888. la. 8°. Ann Arbor, s.a.

——— Circular concerning prizes for tornado studies offered by the American meteorological journal. 8°. s.l.e.a.

Amsterdam, Kon. Nederlandsch Aardrijkskundig Genootschap.—Tijdschrift . . . onder redactie van **C. M. Kan** en **J. Æ. C. A. Timmerman.** Tweede serie. Deel, iv-v. Verslagen en aardrijkskundige mededeelingen. 2 vols. 8°. Amsterdam, 1887–88.
The title "Koninklijk" commences with Deel. iv.

——— ——— Tijdschrift . . . onder redactie van **C. M. Kan** en **J. Æ. C. A. Timmerman.** Tweede serie. Deel, iv.-v. Meer uitgebreide artikelen. 2 vols. 8°. Amsterdam, 1887–88.
The title "Koninklijk" commences with Deel. v.

NOTE.—Books marked * have been acquired by purchase; the others are donations from institutions, societies, or authors. Those marked || are excerpt papers, extra copies of which have been separately printed.
In some cases additional publications have been received besides those specified, but only completed volumes or years are given here.

Anemometers employed in mining operations. 1a. 8°. (*Spons' Dict. Eng., London, Nos.* 2 *and* 3, *p.* 61.)

|| **Augustin, F.**—Über den jährlichen Gang der meteorologischen Elemente zu Prag. 1a. 4°. Prag, 1888. (*Abhandl. k. böhm. Gesellsch. Wissensch.*, vii. *Folge*, 2 *Bd.*)

Avignon, Commission Météorologique du Département de Vaucluse.—Compte-Rendu. 1886–87. 2 vols. sm. f°. (Avignon, s.a.)

Avila, A. J. C. D'.—Annaes meteorologicos do Rio de Janeiro nos annos de 1863 a 1867. Oblong 1a. 8°. Rio de Janeiro, 1868.
For previous years, see A. M. de Mello.

|| **Ball, J.**—On the measurement of heights by the barometer. 1a. 8°. (London, s.a.) (*Suppl. Papers R. Geogr. Soc.*, ii., *part* 3.)

Batavia, Magnetical and Meteorological observatory.—Observations. Published . . . under the direction of Dr. **J. P. Van der Stok.** Vol. viii., 1883–85, x., 1887. 2 vols. f°. Batavia, 1888.

——— **Observatorium.**—Regenwaarnemingen in Nederlandsch-Indië. Negende jaarg., 1887. Door **J. P. Van der Stok.** 8°. Batavia, 1888.
Title page and preface in the English language also.

Batchelder, J. M.—Temperature of the Saco River. 1a. 4°. Sheet. (*Science*, xi., 1888, *p.* 170.)

Berlin, Deutsche meteorologische Gesellschaft.—Berliner Zweigverein der deutschen meteorologischen Gesellschaft. Sechstes Vereinsjahr, 1889. 8°. Berlin, 1889.

——— **hydrographisches Amt der Admiralität.**—Annalen der Hydrographie und maritimen Meteorologie. Organ des hydrographischen Amtes und der Deutschen Seewarte. xvi. Jahrg., 1888. 1a. 8°. Berlin, s.a.

——— **königlich Preussisches meteorologisches Institut.**—Instruktion für die Beobachter an den meteorologischen Stationen II., III., und IV. Ordnung. (Vorwort von **W. v. Bezold.**) 1a. 8°. Berlin, 1888.

[|| ——— ———] Witterung nach den Beobachtungen des königlichen meteorologischen Instituts. 1888, Jan.–Dec. 1a. 4°. (*Statist. Corresp., Berlin*, xiv-xv., 1888–89.)

|| **Bezold, W. von.**—Über eine nahezu 26-tägige Periodicität der Gewittererscheinungen. 1a. 8°. (*Sitz. phys. math. Cl. k. preuss. Akad. Wissensch. Berlin* xxxvi., 1888, *p.* 905.)

|| ——— Zur Thermodynamik der Atmosphaere. 2 parts. 1a. 8°. (*Sitzungsb. k. preuss. Akad. Wissensch. Berlin*, 1888, *p.* 485 *und* 1189.)

* **(Bianchi, P. und X. de.)**—Gebrauch des universal Thermometri, aus acht Authoren, als:—De Lisle, Fowler de Ball, M. Michel du Gre, Fahrenheit, M. de Reaumeur, Newton, De Bergen, de la Hire, in eines zusammen getragen, und von uns verfertiget. sm. 8°. Prag, 1765.

* ——— Von dem Nuzen und Gebrauch des geraden Barometers oder so genannten Wetterglases, nach Eintheilung des pariser Maasstabs. sm. 8°. s.l.e.a.

* **(Bianchy, J. von.)**—Das Merkwürdigste vom Barometre und Thermometre. In sieben Abschnitte zusammen getragen und mit einer neuerfundenen Wetterglas-Tafel versehen. sm. 8°. Wien, 1762.

Bibliothèque universelle [et revue suisse]. Archives des sciences physiques et naturelles.—Troisième période. Tomes xix.–xx. 2 vols. 8°. Genève, 1888.

|| **Birkner, O.**—Bericht über die Wasserkatastrophe in der Lausitz während der Nacht vom 17. zum 18. Mai 1887. 1a. 4°. Chemnitz, s.a. (*Jahrb. k. sächs. meteor. Inst., Jahrg.* v., 1887.)

|| **Blaserna, P.**—Sull' impianto del servizio geodinamico in Italia. 1a. 8°. Roma, 1888. (*Rend. R. Accad. Linc., Cl. sc. moral., stor. e filol.*, iv., *fasc.* 13, *p.* 774.)

* **Bohun, R.**—A discourse concerning the origine and properties of wind. With an historicall account of hurricanes, and other tempestuous winds. sm. 8°. Oxford, 1671.

Bombay, Government Observatory.—Magnetical and meteorological observations made at the Government Observatory, Bombay, in the year 1886, under the direction of **C. Chambers**, with six appendices containing accounts of various magnetic researches. f°. Bombay, 1888.

(Bombay, Government Observatory.)—Report on the condition and proceedings of the Government Observatory, Colába, for the year which ended with the 30th June, 1888. f°. s.l.e.a.

[——— **Meteorological Office.**]—Brief sketch of the meteorology of the Bombay Presidency in 1887–88. f°. (Bombay, s.a.)

(Brisbane, Government Meteorological Observer.)—Preliminary report of the Government meteorologist for the year 1887. (By **C. L. Wragge.**) sm. f°. Brisbane, s.a.

——— **Post and Telegraph Department, Meteorological Branch.**—Account of the operations of the weather bureau and list of stations. la. 8°. (Brisbane, 1888.)

——— ——— Brisbane observatory, Wickham Terrace. Meteorological synopsis. 1887–1888, Jan–Dec. f°. Sheets.

——— ——— Climate of Brisbane. Meteorological synopsis for the weeks ending April 11, 1887, to 9 January, 1888. f°. Sheets.
Week ending April 18 is missing.

——— ——— Table of rainfall during the months of Jan.—Dec., 1887–88. f°. Sheets.

——— ——— Weather chart of Australasia. 1888, Jan. 1 to Dec. 31. la. f°. Sheets.

‖ **Brückner, E.**—Die Schwankungen des Wasserstandes im Kaspischen Meer, dem Schwarzen Meer und der Ostsee, in ihrer Beziehung zur Witterung. Vortrag gehalten vor der Allgemeinen Versammlung der Deutschen meteor. Gesellsch. in Karlsruhe, Ostern 1887. la. 8°. Berlin, 1888. (*Ann. Hydr. mar. Meteor.*, 1888, *Feb.*)

Brussels, Observatoire Royal de Bruxelles.—Bulletin météorologique. 1888, Jan. 1—Dec. 31. f°. Sheets.

Bucharest, Ministerul Agriculturei, Industria, Comerciului si Domenilor.—Buletinul. Anul I., 1885. Nos. 1–12 and Suppl. sm. f°. Bucuresci, 1885–86.

Buenos Ayres, Oficina Meteorológica Argentina.—Anales . . . por su Director **G. G. Davis.** Tomo VI. la. 4°. Buenos Aires, 1888.

Bund, J. W. W.—The Severn watershed. A paper read . . . at the Bath Meeting of the Br. Assoc., 1888. 8°. s.l.e.a.

Burdwood, J.—Sun's true bearing or azimuth tables, computed for intervals of four minutes between the parallels of latitude 30° and 60° inclusive. la. 8°. London, 1885.

* **Butler, T. B.**—A concise analytical and logical development of the atmospheric system, and of the elements of prognostication, by which the weather may be forecasted, adapted to the practical mind of the country. Revised edition. sm. 8°. Norwalk, Conn., 1870.

*‖ **Buys-Ballot, [C. H. D.]**—Storm warnings. sm. f°. Slip. (*Proc. Lit. Phil. Soc. Manch.*, vi., 1867, *p.* 83.)

‖ ——— Verdeeling der warmte over de aarde. 4°. Amsterdam, 1888. (*Verh. Afd. Nat. K. Akad. Wetensch.*, xxvi.)

(Calcutta, Meteorological Office, Bengal.)—Administration report of the meteorological Reporter to the Government of Bengal for the year 1887–88. sm. f°. s.l.e.a.

[——— ———] Bay of Bengal weather chart. 1888, Jan. 1—Dec. 31. sm. f°. Sheets.

——— ——— Bengal daily weather report. 1888. sm. f°. Sheets.
These reports are only published during the rainy season.

(——— ———) Meteorological and rainfall table of the Province of Bengal for the months of January to December 1888, with annual tables. sm. f°.

(——— ———) Meteorological and rainfall table of the Province of Bengal for the weeks ending January 6 to December 28, 1888. f°.

Calcutta, Meteorological Office, India.—Abstract of the results of meteorological observations taken at the Alipore Observatory in the months of Jan.—Dec., 1888. sm. f°. Sheets.

——— ——— Abstract of the results of the thermometric observations taken at the Meteorological Office, Chowringhee. 1888, Jan. to Dec. sm. f°. Sheets.

——— ——— Charts of the Arabian sea and the adjacent portion of the North Indian Ocean, shewing the mean pressure, winds and currents in each month of the year. oblong f°. s.l.e.a.

——— ——— Cyclone memoirs. Part i. Bay of Bengal cyclone of May 20th—28th, 1887. la. 8°. Calcutta, 1888.

[——— ———] India daily weather report. 1888, Jan. 1—Dec. 31. f°. Sheets.

[——— ———] Indian meteorological memoirs. . . . Prepared under the direction of **H. F. Blanford.** Vol. iii. f°. Calcutta, 1886–88.

[——— ———] Preliminary report on the meteorology for the year 1887, prepared in the Meteorological Office, Government of India. f°. (Simla, 1888.)

[——— ———] Report on the administration of the meteorological department of the Government of India in 1887–88. f°. s.l.e.a.

——— ——— Results of the meteorological observations taken at the Alipore Observatory, from 1st January to 29th December, 1888. sm. f°. Sheets.

——— ——— Results of the thermometrical observations taken at the Meteorological Office, Chowringhee, from 1st January to 29th December, 1888. sm. f°. Sheets.

Cambridge (Mass.), New England Meteorological Society, in coöperation with the astronomical observatory of Harvard College.—Bulletin. 1888, Jan.—Dec. Nos. 39–50. 4°. s.l.e.a.

Cape Town, Meteorological Commission, Cape of Good Hope.—Report . . . . for the year 1887. sm. f°. Cape Town, 1888.

Carlsruhe, Centralbureau für Meteorologie und Hydrographie.—Deutsches meteorologisches Jahrbuch für 1887. Grossherzogthum Baden. Die Ergebnisse der meteorologischen Beobachtungen im Jahre 1887. Bearbeitet von . . . **C. Schultheiss.** la. 4°. Karlsruhe, 1888.

|| [——— ———] Ergebnisse der Beobachtungen der meteorologischen Stationen des Grossherzogthums Baden im Jahre 1886. Nach den Angaben der meteorologischen Centralstation Karlsruhe. la. 8°. (*Statist. Jahrb. Grossh. Baden*, 1886.)

——— ——— Uebersicht der Ergebnisse der an den badischen meteorologischen Stationen angestellten Beobachtungen, nebst Wasserstandsaufzeichnungen an den wichtigsten Hauptpegeln des Rheins. 1888, Nos. 231–242. f°. Sheets.

Carruthers, G. T.—The cause of light. 8°. Roorkee, [1888].

(———) The earth's polar floods in perihelion. 8°. Dated, Subathu, India, March, 1888.

Chambers, C.—Views taken from the Colába observatory. 13 plates, oblong sm. 8°. (London, 1878.)

2 plates are missing.

———, **F.**—Recent advances in our knowledge of the law of storms. A lecture delivered . . . at the R. Alfred Sailors' Home, Bombay. la. 8°. Bombay, 1888.

Christiania, Königl. norwegischen Cultus-Ministerium.—Beobachtungs-Ergebnisse der norwegischen Polarstation Bossekop in Alten. Herausgegeben von **A. S. Steen.** II. Theil. Erdmagnetismus. Nordlicht. la. 4°. Christiania, 1888.

——— **Norsk meteorologisk Institut.**—Oversigt over Luftens Temperatur og Nedbør i Norge i Aaret 1887. 8°. Kristiania, 1888.

——— ——— Vejledning til Udførelse af meteorologiske Jagttagelser ved det norske meteorologiske Instituts Stationer. la. 8°. Christiania, 1888.

——— **Norwegisches meteorologisches Institut.**—Jahrbuch . . . für 1887. Herausgegeben von **H. Mohn.** sm. f°. Christiania, 1889.

* **Ciel et Terre.**—Revue populaire d'astronomie, de météorologie, et de physique du globe. 2ᵉ série, année iv.; 1ᵉʳ Mars 1888—16 Février 1889. 8°. Bruxelles, s.a.

Coimbra, Observatorio Meteorologico e Magnetico da Universidade.—Observações meteorologicas feitas no . . . annos de 1886-87. (Prefacio por **A. S. Viégas.**) 2 vols. f°. Coimbra, 1887-88.

|| **Colombo, Surveyor General's Office.**—Report on the meteorology of Ceylon for 1887. By **F. C. H. Clarke.** sm. f°. (*Administr. Rep.*, 1887, *Part* ii., *p.* 13 *B.*)

——— ——— Results of meteorological observations in Ceylon during the months of January to December 1888. f°. Sheets. (*Suppl. to the Ceylon Gov. Gazette*, 1888-89.)

* **Copenhagen and Hamburg, Dänisches meteorologisches Institut und Deutsche Seewarte.**—Tägliche synoptische Wetterkarten für den nord-atlantischen Ozean und die anliegenden Theile der Kontinente. Viertes, Erstes und Zweites Quart., Sept. 1884—Mai, 1885. 3 vols. f°. Copenhague et Hambourg, 1887-88.

In the French language also.

Copenhagen, dansk meteorologisk Institut.—Bulletin météorologique du Nord, publié par les Instituts météorologiques de Norvége, de Danemark et de Suède. Année 1888. Oblong 8°. Copenhague, s.a.

——— ——— Maanedsoversigt over Vejrfôrholdene. 1888, Jan.—Dec. f°.

——— **Kongelige danske Videnskabernes Selskab.**—Oversigt over det . . . . Forhandlinger og dets Medlemmers Arbejder i Aaret. 1887. la. 8°. Kjøbenhavn, 1887-88.

* **Corbin, D. F. M.**—A life of Matthew Fontaine Maury, U.S.N. and C.S.N., Author of "Physical geography of the sea and its meteorology." 8°. London, 1888.

|| **Cracow, C. K. Akademii Umiejętności w Krakowie.**—Materyjaly do klimatografii Galicyi zebrane przez sekcyę meteorologiczną komisyi fizyograficznej. 1887. la. 8°. Kraków, 1888. (*Odbitak ze Sprawozd. Kom. fizyogr.*)

——— **K. K. Sternwarte in Krakau.**—Meteorologische Beobachtungen. 1888, Jan.—Dec., and Results. la. 8°. Sheets.

Croydon, Microscopical and Natural History Club.—Daily rainfall at stations in Kent and Surrey. 1888, Jan.—Dec. 4°. Sheets.

Cruls, L.—Dictionnaire climatologique universel. Réponse à un article publié dans le Meteorologische Zeitschrift. la. 8°. Rio de Janeiro, 1888.

[Dehra Dun, Surveyor General of India.]—Account of the operations of the great trigonometrical survey of India. Vol. x. Electro-telegraphic longitude operations executed during the years 1881-2, 1882-83, and 1883-84 by Major **G. Strahan** and Major **W. J. Heaviside.** la. 4°. Dehra Dun, 1887.

* ——— ——— Contour map of India, 1886, based on a system of a proximate contours. 2 sheets, la. f°. Calcutta, 1887.

——— ——— General report on the operations of the Survey of India Department . . . . . during 1886-87. Prepared under the direction of Col. **H. R. Thuillier.** sm. f°. Calcutta, 1888.

Denza, F.—Determinazione dei valori assoluti degli elementi magnetici in Italia. Parte prima. Preliminari. sm. f°. Torino, 1888.

|| ——— I terremoti di novembre e di dicembre 1887 in Italia. la. 8°. Torino, 1888. (*Boll. Mens. Osserv. Moncalieri, serie* ii., viii., *N.* 1 *e.* 2—*Con aggiunte.*)

* **Dick, T.**—The atmosphere and atmospherical phenomena. The telescope and microscope. sm. 8°. London, s.a.

Dove, K.—Das Klima des aussertropischen Südafrika mit Berücksichtigung der geographischen und wirtschaftlichen Beziehungen nach klimatischen Provinzen dargestellt. 8°. Göttingen, 1888.

Dublin, General Register Office.—Quarterly returns of the marriages, births, and deaths registered in . . . Ireland; . . . . . 1888. 1st—4th quarters, Nos. 97-100. la. 8°. Dublin, 1888-89.

——— ——— Weekly returns of births and deaths in Dublin (including its suburban districts), and in fifteen of the principal urban sanitary districts in Ireland, 1888. Vol. xxv. la. 8°. Dublin, 1889.

Dublin, Royal Dublin Society.—The scientific proceedings. New series. Vol. v. 8°. Dublin, 1886–87.

——— ——— The scientific transactions. Vol. iii., series ii. 4°. Dublin, 1888–87.

[Eberswalde, Hauptstation des forstlichen Versuchswesen in Preussen.]—Beobachtungs-Ergebnisse der von den forstlichen Versuchsanstalten des Königreichs Preussen, des Herzogthums Braunschweig, der thüringischen Staaten, der Reichslande und dem Landesdirectorium der Provinz Hannover eingerichteten forstlich-meteorologischen Stationen. Herausgegeben von **A. Müttrich.** Vierzehnter Jahrg. 1888, Jan.–Dec. 8° Berlin, s.a.

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‖ **Williams, C. T.**—On the results of the treatment of pulmonary consumption by residence at high latitudes, as exemplified by an analysis of 141 cases. 8°. London, 1888. (*Trans. R. Med. Chir. Soc. London*, lxxi., *p.* 297.)

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APPENDIX XV.

METEOROLOGICAL OFFICE: ACCOUNT of RECEIPTS and PAYMENTS for the year ending 31st March 1889.

RECEIPTS.

	£ s. d.	£ s. d.
Balance from year 1887–88		2,961 4 11
Parliamentary Vote		15,300 0 0
Repayment of expenses charged under—		
(1.) Incidental expenses	15 8 4	
(2.) Special researches	0 16 8	
		16 5 0
SUPPLY OF INFORMATION:		
D.W. Charts and Forecasts	231 16 1	
6 p.m. Charts	25 0 0	
Information for Press Agencies, &c.	94 14 10	
Telegrams	330 19 9	
		682 10 8
SALE OF INSTRUMENTS, &c.:		
Royal Navy (A)	16 11 6	
Mercantile Marine account (B)	16 2 10	
		32 14 4
Commissions executed for Colonial and Foreign Institutions, &c. (C)		290 3 1
Commission charged on work done for Colonies, &c.		16 3 7
		£19,299 1 7

PAYMENTS.

	£ s. d	£ s. d.
ADMINISTRATION:		
Payment of Council	1,000 0 0	
Secretary	800 0 0	
Salaries and wages	798 8 0	
Rent, fuel, and lighting	715 10 11	
Incidental and contingent expenses:—		
Attendance, cleaning, &c.	342 5 4	
Furniture and fittings	95 12 2	
Expenses incidental to International Meteorological Congress	22 2 3	
Pensions	138 16 4	
		3,912 15 0
SPECIAL RESEARCHES		586 14 2
LAND METEOROLOGY:		
Observatories and stations	1,974 16 1	
Salaries: — Discussion and reduction of observations	1,328 16 0	
		3,303 12 1
WEATHER INFORMATION AND FORECASTS:		
Telegraphic reports and storm warnings	2,744 12 8	
Salaries:— Preparation and issue of reports and forecasts	1,681 18 3	
		4,426 10 11
INSPECTIONS:		
Salaries and travelling expenses		602 5 1
OCEAN METEOROLOGY:		
Salaries:— Discussion and reduction of observations	1,677 4 8	
Expenses incidental to the supply of instruments:—		
Proportion for care and issue of instruments	200 0 0	
Royal Navy	392 18 5	
Mercantile Marine	390 19 4	
Distant island and coast stations	31 0 3	
		2,692 2 8
Commissions executed for Colonial and Foreign Institutions, &c.		306 8 11
BALANCE:		
Cash at Bank	3,365 16 6	
„ at Office	72 16 3	
Advance for inspections	30 0 0	
		3,468 12 9
		£19,299 1 7

APPENDIX XVI.

LIST OF PUBLICATIONS, &c. issued under the Authority of the Meteorological Council.

OFFICIAL.

No. 1. Report for 1867. Presented to Parliament. 1*s.*
2. Instructions for Meteorological Telegraphy. New Edition. (1875.) 6*d.*
3. Fishery Barometer Manual. (New edition, 1887.) 6*d.*
4. Charts of Surface Temperature, South Atlantic Ocean. 2*s.* 6*d.*
5. Report for 1868. Presented to Parliament. 5*d.*
6. Report for 1869. Presented to Parliament. 10*d.*
7. Quarterly Weather Report for 1869.—Parts I. to IV. 5*s.* each.
8. Barometer Manual. (Out of print, see Nos. 3, 24, 40, 60, and 61.)
9. Quarterly Weather Report for 1870.—Parts I. to IV. 5*s.* each.
10. Report for 1870. Presented to Parliament. 10*d.*
*11. Contributions to our Knowledge of the Meteorology of Cape Horn and the West Coast of South America. 2*s.* 6*d.*
*12. Currents and Surface Temperature of the North Atlantic Ocean, from the Equator to Lat. 40° N., for each month of the year, with a General Current Chart. 2*s.* 6*d.*
13. A Discussion of the Meteorology of the Part of the Atlantic lying North of 30° N., for the Eleven Days ending 8th February 1870. Price, with Book of Charts, 5*s.*
14. Quarterly Weather Report for 1871.—Parts I. to IV. 5*s.* each.
15. Report for 1871. Presented to Parliament. 10*d.*
16. Quarterly Weather Report for 1872.—Parts I. to IV. 5*s.* each.
17. Report for 1872. Presented to Parliament. 1*s.*
18. Contributions to our Knowledge of the Meteorology of the Antarctic Regions. 2*s.*
19. Quarterly Weather Report, 1873.—Parts I. to IV. 5*s.* each.
20. Charts of Meteorological Data for Square 3. Lat. 0°—10° N. Long. 20° — 30° W., and Remarks to accompany the Monthly Charts, which show the Best Routes across the Equator for each Month, &c. 20*s.*
21. Report of the Proceedings of the Meteorological Congress at Vienna. 1*s.*
22. Report for 1873. Presented to Parliament. 4*d.*
23. Report of the Proceedings of the Conference on Maritime Meteorology held in London, 1874. 2*s.*
24. Instructions in the Use of Meteorological Instruments. [Reprinted 1888.] 2*s.* 6*d.*
25. Quarterly Weather Report for 1874.—Parts I., II., and IV. 5*s.* each. Part III., 5*s.* 9*d.*
26. Report for 1874. Presented to Parliament. 6*d.*

* The Meteorological Council have given away the copies which were placed at their disposal, but the book can be purchased from the Publishers.

LIST OF PUBLICATIONS, &c.—*continued.*

No. 27. Charts of Meteorological Data for the Nine 10° Squares of the Atlantic which lie between 20° N. and 10° S., and extend from 10° to 40° W., with accompanying Remarks, ending with the Best Routes across the Equator. 24*s.*

28. Contributions to our Knowledge of the Meteorology of Japan. By Staff-Commander Thomas H. Tizard, H.M.S. *Challenger.* 1*s.*

29. Report for 1875. Presented to Parliament. 4*d.*

30. Quarterly Weather Report for 1875.—Parts I.—IV. 5*s.* each.

31. Report for 1876–7. Presented to Parliament. 3*s.* 5*d.*

32. A Discussion of the Meteorology of the North Atlantic during August 1873, with 31 Synoptic Charts. 15*s.*

33. Quarterly Weather Report for 1876 (New Series).—Part I., 6*s.*; Parts II., III., and IV., 5*s.* each.

*34. Contributions to our Knowledge of the Meteorology of the Arctic Regions. Vol. I.,—Part I., 2*s.*; Part II., 10*s.*; Part III., 6*s.*; Part IV., 5*s.*; Part V., 6*s.*

35. Report for 1877–8. Presented to Parliament. 1*s.*

36. Report of the Proceedings of the Meteorological Congress at Rome, 1879. 1*s.* 6*d.*

37. Report on the Meteorology of Kerguelen Island. By the Rev. S. J. Perry, S.J., F.R.S. 3*s.*

38. Report for 1878–9. Presented to Parliament. 5*d.*

39. Meteorological Observations at Stations of the Second Order for the year 1878. 20*s.*

40. Aids to the Study and Forecast of Weather, by the Rev. W. Clement Ley, M.A. 1*s.*

41. Report for 1879–80. Presented to Parliament. 1*s.*

42. Report for 1880–81. Presented to Parliament. 1*s.* 2*d.*

43. Charts of Meteorological Data for the Ocean District adjacent to the Cape of Good Hope, with accompanying Remarks. Price of the Charts, 25*s.*; of the Remarks, 7*s.*

44. Report on the Gales experienced in the Ocean District adjacent to the Cape of Good Hope, between Lat. 30° and 50° S., and Long. 10° and 40° E., by Capt. H. Toynbee. 7*s.* 6*d.*

45. Meteorological Observations at Stations of the Second Order for the year 1879. 20*s.*

46. Report on the Storm of October 13–14, 1881. By Robert H. Scott, F.R.S. 1*s.* 6*d.*

47. Rainfall Tables of the British Isles for 1866–80. Compiled by G. J. Symons, F.R.S. 7*s.* 6*d.*

48. Report for 1881–2. Presented to Parliament. 1*s.*

49. Quarterly Weather Report for 1879. (New Series.) Appendices and Plates. 27*s.* Parts I., II., and III., 6*s.* each. Part IV., 5*s.* 6*d.*

50. Quarterly Weather Report for 1880. (New Series.) Appendices and Plates. 28*s.* Part I. 6*s.* Part II. (In the Press.)

51. Hourly Readings, 1881. (New Series.) Part I., 10*s.* 6*d.* Parts II., III., and IV., 21*s.* each.

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* The Meteorological Council have given away the copies which were placed at their disposal, but the book can be purchased from the Publishers.

LIST OF PUBLICATIONS, &c.—*continued.*

No. 52. Quarterly Weather Report for 1877. (New Series.) Appendices and Plates. 27*s.*; Part I., 10*s.*; Part II., 5*s.*; Part III., 4*s.* 6*d.*; Part IV., 6*s.*

53. Meteorological Atlas of the British Isles. 5*s.* 6*d.*

54. Hourly Readings, 1882. Parts I. and II., 20*s.* each. Part III., 22*s.* 6*d.* Part IV., 26*s.*

55. Quarterly Weather Report for 1878. (New Series.) Appendices and Plates. 28*s.*; Parts I., II., III., and IV., 6*s.* each.

56. Sunshine Records of the United Kingdom for 1881. 4*s.*

57. Meteorological Observations at Stations of the Second Order for the year 1880. 34*s.* 6*d.*

58. Report for 1882–3. Presented to Parliament. 10½*d.*

59. Sea Temperature Charts for the Atlantic, Pacific, and Indian Oceans. 21*s.*

60. Principles of Weather Forecasting. By the Hon. Ralph Abercromby, F.R.Met.Soc. (Second edition, revised), 2*s.*

61. A Barometer Manual for the Use of Seamen. 1*s.* 3*d.*

62. Monthly Weather Report, 1884. Jan., Feb., March, May—Nov., 1*s.* 6*d.* each. April (with 2 Appendices), 2*s.* 6*d.* Dec., 1*s.* 9*d.*

63. Hourly Readings, 1883. Parts I., II., and III., 21*s.* each. Part IV., 30*s.*

64. Report for 1883–4. Presented to Parliament. 1*s.* 2*d.*

65. Monthly Weather Reports for 1885. Jan. to Dec. 1*s.* 6*d.* each.

66. Meteorological Observations at Stations of the Second Order for the year 1881. 35*s.*

67. Report for 1884–5. Presented to Parliament. 4*s.* 4*d.*

68. Monthly Weather Reports for 1886. Jan. to Dec., 1*s.* 6*d.* each.

69. Meteorological Observations at Stations of the Second Order for the year 1882. 35*s.*

70. Hourly Readings, 1884. Part I., 12*s.*; Part II., 10*s.*; Part III., 10*s.* 6*d.*; Part IV., 15*s.*

71. Synchronous Weather Charts of the North Atlantic and the adjacent Continents. Aug. 1, 1882 to Sept. 3, 1883. Parts I. to IV. (33 sheets each.) 17*s.* each.

72. Report for 1885–86. Presented to Parliament. 8*d.*

73. Meteorological Observations at Stations of the Second Order for the year 1883. 30*s.*

74. Hourly Readings, 1885. Parts I. and II., 11*s.* each. Part III., 10*s.* 6*d.* Part IV., 12*s.*

75. Report for 1886–87. Presented to Parliament. 8*d.*

76. Charts showing the Mean Barometric Pressure over the Atlantic, Indian, and Pacific Oceans. 10*s.* 6*d.*

77. Monthly Weather Reports for 1887. January to April, 1*s.* 6*d.* each. May. (In the Press.)

78. Meteorological Observations at Stations of the Second Order for the year 1884. 32*s.*

79. Report for 1887–88. Presented to Parliament. 1*s.*

80. Daily Weather Charts of the Arabian Sea for the period of six weeks ending June 25, 1885 (The Aden Cyclone). (In the Press.)

LIST OF PUBLICATIONS, &c.—*continued.*

No. 81. Hourly Readings. 1886. Parts I., II., and III. 10*s.* 6*d.* each. Part IV. 12*s.* 6*d.*

82. Meteorological Observations at Stations of the Second Order for the year 1885. 34*s.*

83. Results of Observations made at Foreign and Colonial Stations, 1852–1886, by the Royal Engineers and Army Medical Department. (In the Press.)

NON-OFFICIAL.

No. 1. Report to the Committee on the Connexion between Strong Winds and Barometrical Differences.—By Robert H. Scott, Director of the Office. 6*d.*

*2. Report to the Committee on the Meteorology of the North Atlantic.—By Captain H. Toynbee, Marine Superintendent. 1*s.*

*3. Report to the Committee on the Use of Isobaric Curves.—By Captain H. Toynbee, Marine Superintendent. 1*s.*

4. Routes for Steamers from Aden to the Straits of Sunda and back. Translated from a Paper issued by the Royal Meteorological Institute of the Netherlands. 6*d.*

5. On the Winds, &c. of the North Atlantic along the Tracks of Steamers from the Channel to New York. Translated from a Paper issued by the Deutsche Seewarte, Hamburg. 6*d.*

6. Report of the Proceedings of the Meteorological Conference at Leipzig. 1*s.*

7. Notes on the Form of Cyclones in the Southern Indian Ocean.—By C. Meldrum, M.A., F.R.S. 6*d.* [Out of Print.]

8. Report on Weather Telegraphy and Storm Warnings. Presented to the Meteorological Congress at Vienna. 6*d.*

9. Report of the Permanent Committee of the Vienna Congress for 1874. 1*s.* 6*d.*

10. On the Physical Geography of that part of the Atlantic which lies between 20° N. and 10° S. and extends from 10° to 40° W. A Paper read before the British Association at Bristol, in August 1875.—By Capt. Toynbee, F.R.A.S., F.R.G.S., Marine Superintendent. 1*s.* 6*d.*

11. Report of the Permanent Committee of the Vienna Congress for 1876. 2*s.*

12. Reports to the Permanent Committee of the Vienna Congress on Atmospheric Electricity, Maritime Meteorology, and Weather Telegraphy, 1878. 2*s.*

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* The Meteorological Council have given away the copies which were placed at their disposal, but copies can be purchased from the Publishers.

LIST OF PUBLICATIONS, &c.—*continued.*

No. 13. Report of the Permanent Committee of the Vienna Congress for 1878. 6*d.*

14. Report of the International Meteorological Committee Meeting at Berne, 1880. 1*s.*

15. Report of the Second Meeting of the International Meteorological Committee, held at Copenhagen, August 1882. 2*s.* 6*d.*

16. Report of the Third Meeting of the International Meteorological Committee, held at Paris, September 1885. 1*s.*

17. Report of the Fourth Meeting of the International Meteorological Committee held at Zürich, September 1888. 4*d.*

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LONDON: Printed by EYRE and SPOTTISWOODE,
Printers to the Queen's most Excellent Majesty.
For Her Majesty's Stationery Office.

Parliamentary—*continued.*

[illegible]	Trade Returns of the several British Colonies (1886-1891), with comparative returns relative to the population and general condition.
[illegible]	Trade Returns of Her Majesty's Representatives in Foreign Countries, 1888-1892, and reports on Commercial and Treaty Relations.

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OF THE

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TO THE

ROYAL SOCIETY,

FOR THE YEAR ENDING 31st OF MARCH 1868.